MAINTENANCE MANUAL

W22 INDICATOR SERIES

CONTENTS

1. INTRODUCTION

2. SPECIFICATIONS
- 2.1 SYSTEM BLOCK DIAGRAM
- 2.2 PHYSICAL LAYOUT OF ELECTRICAL CONNECTION
- 2.3 GENERAL SPECIFICATIONS
- 2.4 OPTIONAL INTERFACE
- 2.5 LOAD CELL CONNECTION

3. INITIAL SETUP
- 3.1 PARAMETER SETTING
- 3.2 CALIBRATION AND PARAMETER SETUP
- 3.3 PRINTTING LABEL FORMATS

4. TROUBLE SHOOTING
- 4.1 TROUBLE SHOOTING LOOP
- 4.2 PARTS AND COMPONENTS TROUBLE SHOOTING

5. ELECTRICAL CIRCUITRY
- 5.1 SCHEMATICS
- 5.2 PCB LAYOUT

6. BILL OF MATERIAL

7. APPENDIX

NOV 2005

Specifications and Function Subject to Change without Notice

1. INTRODUCTION

This maintenance manual contains of certain information that may result in fraudulent use. Do not release any part of this manual to any end users or un-authorized persons.

Built-in Pass Word configuration to prevent un-authorized settings or alternations.

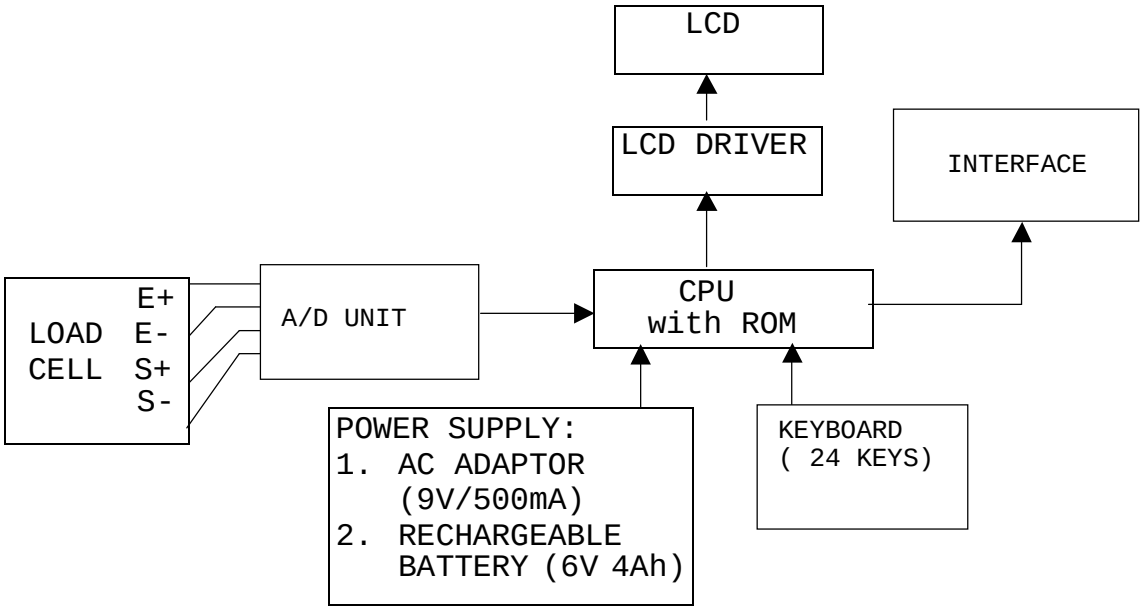
After servicing, it is necessary to go through all tests and procedures to ensure the scale meets all the meteorological and approval requirements.

Here are some features of the W22 series

1. Zero indicator
2. Tare indicator
3. Negative value indicator
4. Subtractive tare function
5. Power on zero function
6. Manual zero function
7. 6 x 26mm wide angle LCD digits
8. Dual power: - By built-in rechargeable battery and external AC/DC power adaptor
9. Low battery warning signal
10. Dual color charge status indicator
11. Full digital Calibration
12. AC/DC power adaptor included
13. Pass word configuration / parameter setting protection
14. User Programmable display resolution(up to 1/30000, Dual interval)
15. Built-in EL backlight
16. Equipped with RS232 interface
17. Optional printer(built-in or external) & relay output interface

2. SPECIFICATION

2.1 SYSTEM BLOCK DIAGRAM

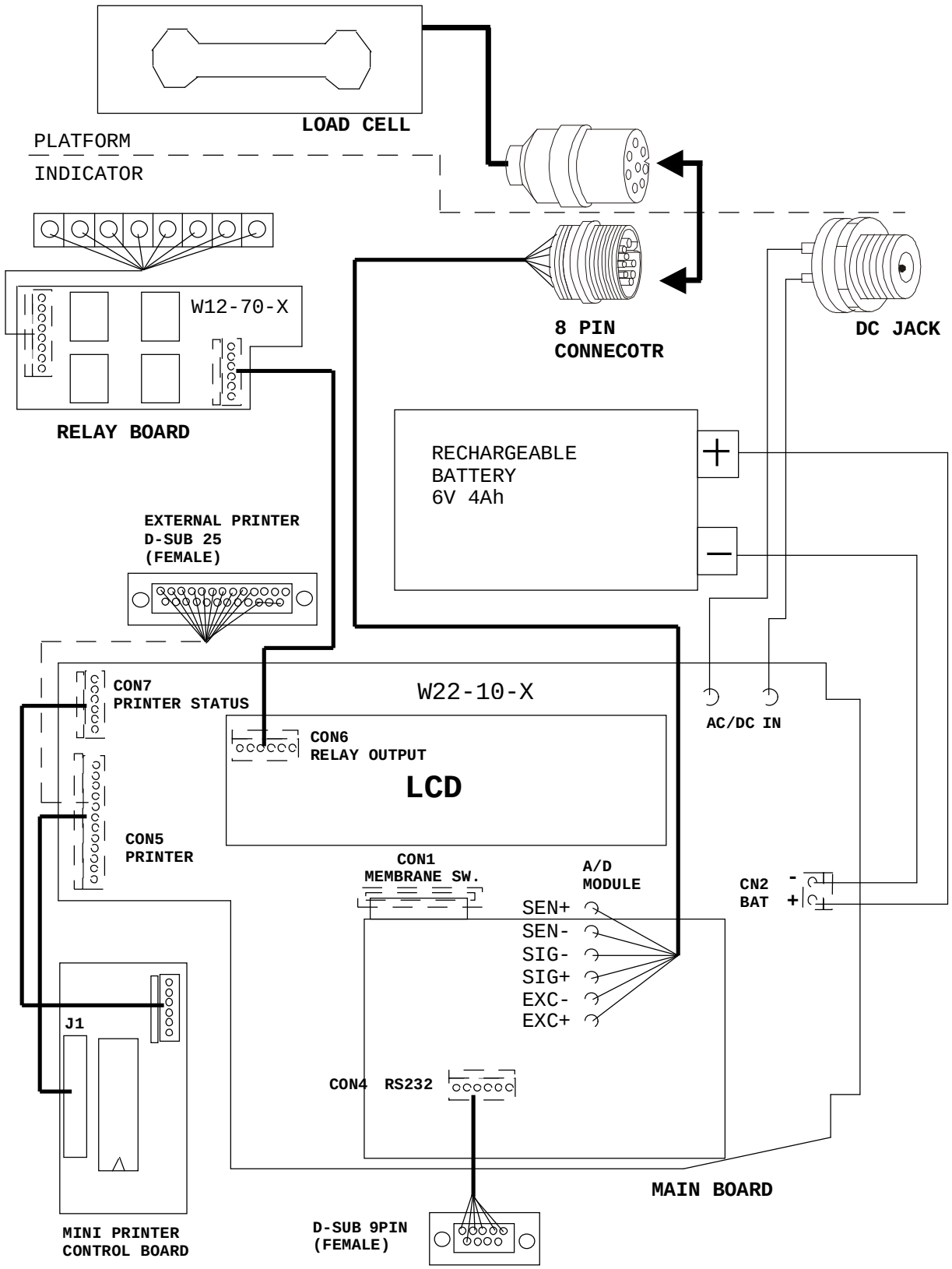


Description:
When an article is placed on the platter, the load of the article is applied to the load cell inside the scale.

The resistance to the excitation current in the strain gauge will then changed and the analog output signal varies.

It is amplified and digitized continuously by the A/D converter into a digital signal. Subsequently, the resulting count is processed and managed by the CPU. The CPU refers to the instructions from the keyboard, and then conveys the output data to LCD driver, which formats the data into readout on the display panels.

2.2 PHYSICAL LAYOUT OF ELECTRICAL CONNECTION



2.3 GENERAL SPECIFICATIONS

2.3.1 Overall View

2.3.2 Overall Dimension:

300(W) X 210(D) X 130(H)mm Max.

2.3.3 Technical Specifications

PERFORMANCE	
Display	6 digit LCD , 26 m/m height
Display resolution	up to 30,000 divisions , minimum of 0.1μV / div.
Count-by	1 , 2 , 5 , 10 , 20 , 50
Display speed	25 times / second
Zero adjustment	－2mV to 20mV
Span adjustment	0.6 mV/V to 4mV/V full scale
Stability / Drift	Zero＜0.3μV / ℃ Span＜8ppm / ℃ Linearity＜0.0033% R.O. Noise＜0.05μVp-p
Operating environment	Temperature 0℃～40℃（32℉～104℉） Humidity ＜90 % non condensing
A/D CONVERTER	
Type	24 bit Sigma－Delta
Resolution	Up to 1,000,000 internal counts
Conversion rate	50 times/second
LOAD CELL	
Excitation	5 volts for up to 8 x350Ω load cell
Load cell connection	7 Wires（Exc^+, Exc^-, Sig^+, Sig^-, Sen^++, Sen^- , Gnd）
INTERFACE	
RS-232C	Baud rate , transmission mode selectable
Printer	Centronics type(Built-in or External)
Relay Output	4 points of HI, OK, LO, Zero Band
POWER SUPPLY	
AC Adaptor	9V / 500 mA
Rechargeable battery	6V , 4Ah
Power Consumption	Normal = 0.1W Charging = 5W

2.3.4 Main Components Used

Microprocessors: SM89516AC25P
Crystal Oscillator: 11.0592MHz
Display Device: WTN Liquid Crystal Display
A/D converter： AD7730
LCD driver IC： PCF8576CT

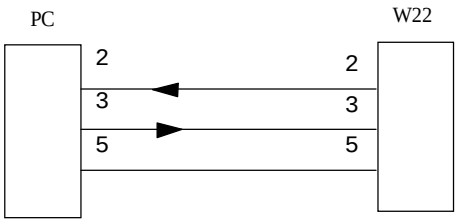
2.4 OPTIONAL INTERFACE

2.4.1 Serial RS-232C Port (D-SUB 9 pin)

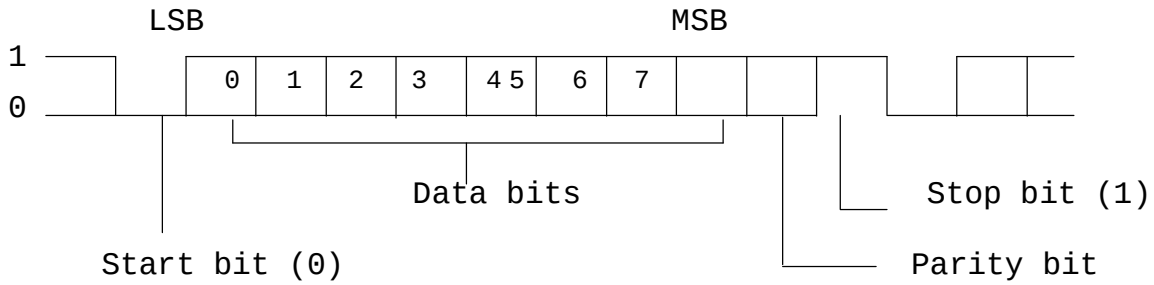
PIN ASSIGNMENT

PIN NUMBER	ASSIGNMENT
1	DCD
2	TXD
3	RXD
4	DTR
5	GND
6	DSR
7	RTS
8	CTS

Short-circuited internally



A SIMPLE WAY TO LINK IS PIN 2,3,5 USED TO COMMUNICATE WITH THE OTHER DEVICE.



Type：EIA-RS-232C
Method：Half-duplex, asynchronous transmission
Format：
Baud rate ：300,600,1200,2400,4800,9600 or 19200
Data bit ：7 or 8
Parity bit：Even or None
Stop bit ：1
Code ：ASCII

Transmission mode：

1. KPC(KEYBOARD PRINT CONTROL)
2. AUTO(AUTO PRINT PER WEIGHING EVENT,RESET BY RETURN TO ZERO BAND,<100 div.)
3. SM(STREAM MODE,CONTINUOUS TRANSMISSION)
4. CMD(COMMAND MODE)

(REFER TO 3.1.1 Setting Basic Parameters)

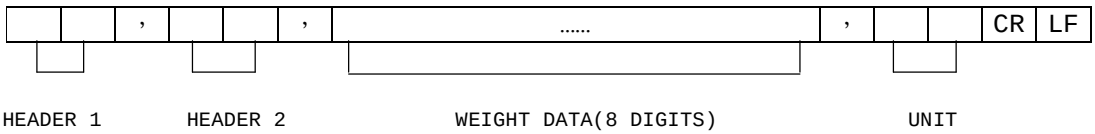
Command Mode Transmission：

1. (READ)(CR)(LF)----ASCII CODE

PC **à**

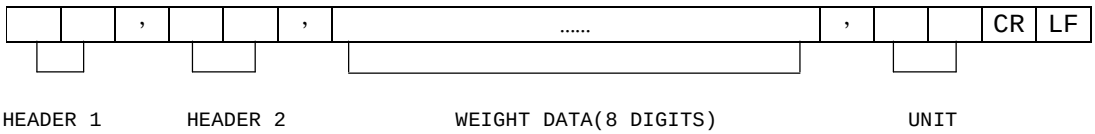
R	E	A	D	CR	LF
52H	45H	41H	44H	0DH	0AH

Indicator **à**

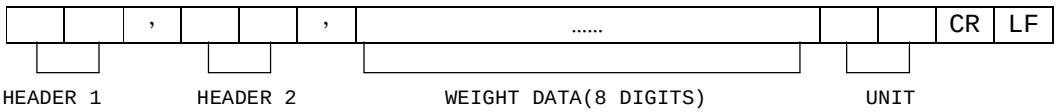


Data Format：

Format1



Format2



HEADER 1	HEADER 2	Unit
OL：Overload	NT：Net weight	kg，lb，g，t
ST：Stable	GS：Gross weight	
US：Unstable		

Other Commands as follow：

2.(ZERO)(CR)(LF)→ To utilize ZERO function.
3.(TARE)(CR)(LF)→ To utilize TARE function.
4.(NTGS)(CR)(LF)→ To change over Net/Gross.

2.4.2 Parallel Printer Interface (D-SUB 25 pin)

PIN ASSIGNMENT

PIN NUMBER	ASSIGNMENT
1	STROBE
2	D0
3	D1
4	D2
5	D3
6	D4
7	D5
8	D6
9	D7
11	BUSY
25	GND

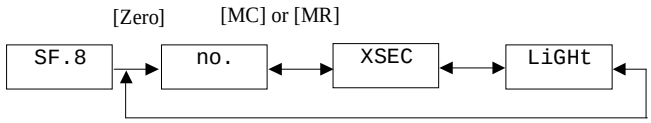
2.4.3 Relay Output

1. RELAY OUTPUT CAPACITY (MAX)：AC120V 1A，DC24V 2A。
2. 4 RELAY OUTPUT PIN SETS: HI、OK、LO、ZERO BAND.

PIN ASSIGNMENT

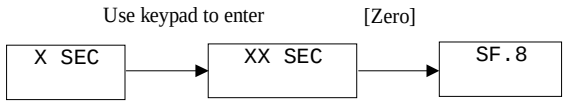
PIN NUMBER	ACTION	FIGURE
1. HI (Normal Open)	OPEN/ SHORT	
2. HI (Common)		
3. OK (Normal Open)	OPEN/ SHORT	
4. OK (Common)		
5. LO (Normal Open)	OPEN/ SHORT	
6. LO (Common)		
7. ZERO BAND (Normal Open)	OPEN/ SHORT	
8. ZERO BAND (Common)		

2.4.4 Backlight Facility

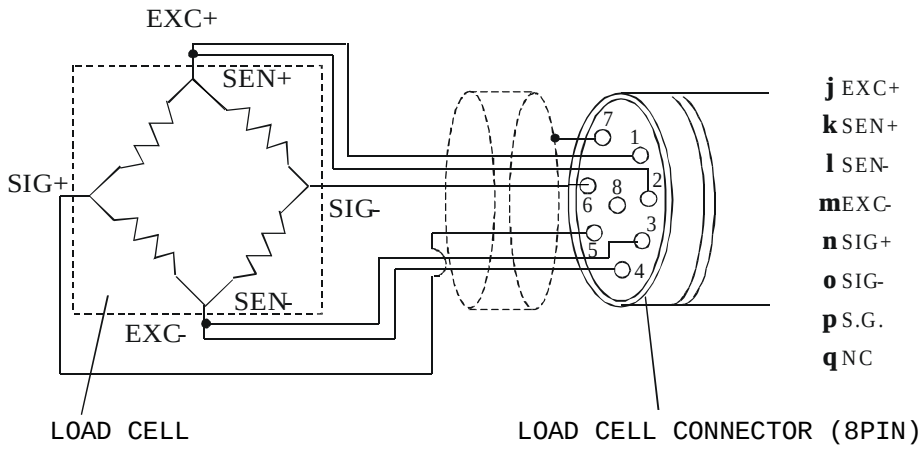


Backlight Select by entering SF.8
no. : Backlight off
XSEC : Turn on the backlight for X seconds (Max = 20 sec)
LiGHt : Always turn on the backlight

When the XSEC is selected, press the number keypad to enter the time setting and press "**Zero**" to confirm it.



2.5 LOAD CELL CONNECTION (Circular connector 8 pin)



PIN	NAME
1	EXC+
2	SEN+
3	SEN-
4	EXC-
5	SIG+
6	SIG-
7	S.G.
8	N.C.

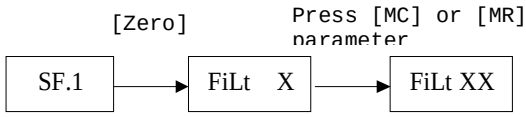
3. INITIAL SETUP

3.1 PARAMETER SETTING:

NOTE. Hold "**MC**" and press "**ON**" to enter to Parameter Setting mode menu (Press "**MR**" (up) or "**MC**" (down) "**ESC**" (abandon) "**Zero**" (confirm) to chose the menu：SF.1, SF.2, ….), Press "**Zero**" to enter to the each single feature for setting. If any mistake occurs during the procedure, press "**ESC**" to abandon the setting.

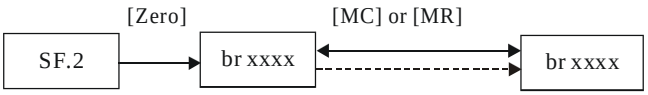
SF.1 -> DIGITAL FILTER SETUP: (default = 5)
SF.2 -> RS-232 BAUD RATE SETUP: (default = 9600 bps)
SF.3 -> RS-232 DATA PROTOCOL SETUP: (default = E.7.1)
SF.4 -> DATA TRANSMISSION MODE: (default = StrAñ **)**
SF.5 -> DATA FORMAT: (default = Fort3)
SF.6 -> OPERATION MODE SETUP: (default : ñ_HiLo**)**
SF.7 -> RELAY OUTPUT SETUP: (default = Out_Hi)
SF.8 -> BACKLIGHT SELECTION: (default = 3 sec)
SF.9 -> RELAY OUTPUT ZERO RANGE SETUP: (default = 0)
SF.10-> AUTO POWER OFF SETUP: (default = 30 min)
SF.11-> AUTO ZERO TRACKING RANGE SETUP: (default = 0)
SF.12-> DATE SETUP
SF.13-> TIME SETUP
SF.14-> BEEP MODE SETUP: (default = bEPoFF)
SF.15-> PASSWORD SETUP: (default = 0)

3.1.1 DIGITAL FILTER SETUP: (default = 5)



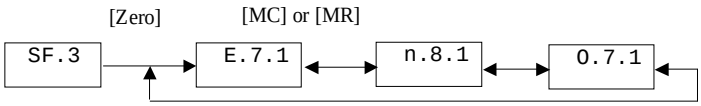
SF.1	Digital Filter Strength	Response Speed	Environment Interference Stability
0	NO	QUICK	BAD
1	WEAK		
2			
3			
4	⬆	⬆	⬆
5			
6	⬇	⬇	⬇
7			
8			
9			
10	STRONG	SLOW	EXCELLENT

3.1.2 RS-232 BAUD RATE SETUP: (default = 9600 bps)



Baud Rate : (300bps , 600bps , 1200bps , 2400bps , 4800bps , 9600bps , 19200bps)

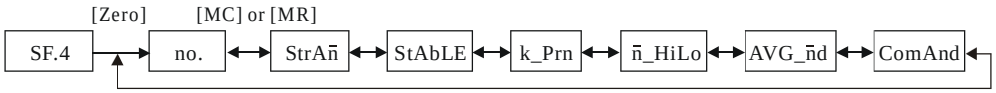
3.1.3 RS-232 DATA PROTOCOL SETUP: (default = E.7.1)



Parity Check Setting:

E.7.1 : Even parity check bit : 7 data bits, 1 stop bit.
N.8.1 : No parity check bit : 8 data bits, 1 stop bit.
O.7.1 : Odd parity check bit : 7 data bits, 1 stop bit.

3.1.4 DATA TRANSMISSION MODE: (default = StrAn̄)



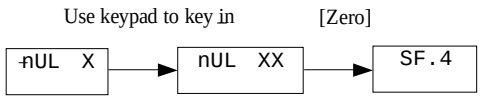
Data Transmission Mode (Printer / RS-232)

no.	Send nothing
StrAn̄	Continuous Send Mode
StAbLE	Send after stable Mode
k_Prn	Press "Print" to send Mode
n̄_HiLo	Accumulation or HI,OK,LO send Mode
AVG_n̄d	Health scale (Animal scale) Mode
ComAnd	RS232 Command Mode

Command Mode:

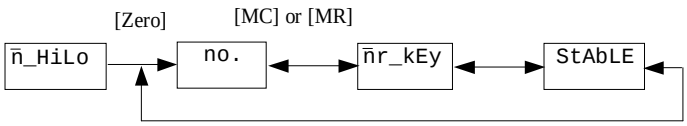
A.(READ)(CR)(LF)→ Read data from Indicator.
B.(ZERO)(CR)(LF)→ This command works the same way with key "ZERO".
C.(TARE)(CR)(LF)→ This command works the same way with key "TARE".
D.(NTGS)(CR)(LF)→ This command works the same way with key "NET/GROSS".

n̄UL X (Stable Time Setting) submenu:
The n̄UL X appears when the data transmission mode has been set up. When the nUL X shows on the screen, key in the value from **1 to 20** to confirm the time of stability. The large the number is, the scale needs the longer time to get stable.



3.1.4.1 n̄_HiLo (default = n̄r_key)

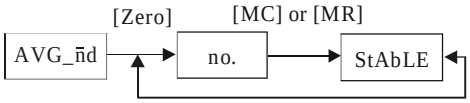
If the data transmission mode is set as n̄_HiLo, then, an extra step has to be taken after stable time setting.



n̄_HiLo	no.	Disable
	n̄r_key	Press "M+" to send data
	StAbLE	Auto-Send data after stable

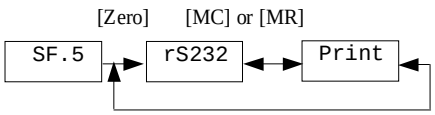
3.1.4.2 AVG_n̄d

If the data transmission mode is set as AVG_n̄d than, an extra step has to be taken after stable time setting.

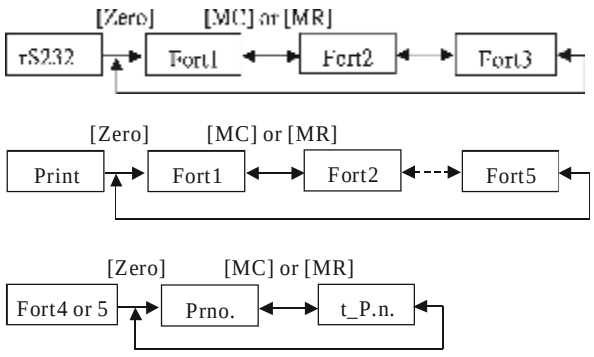


AVG_n̄d	no.	Disable
	StAbLE	Auto-Send After Stable

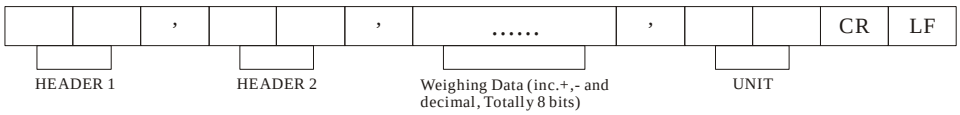
3.1.5 DATA FORMAT: (default = Fort3)



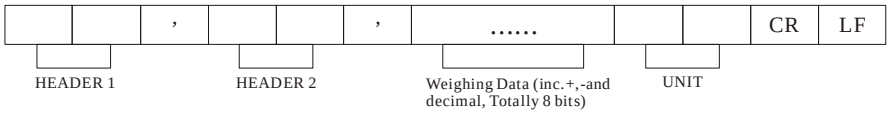
Data Format (RS-232 / PRINTER)
RS-232 has 3 data formats (Format1~Format3)
PRINTER can use 5 data formats (Format1~Format5)
Format1~Format3 is specially designed for peripheral Printer (Dot-Matrix，9 pin or 24 pin) format
Format4 is for built in MINI PRINTER format
Format5is for peripheral THERMAL BAR CODE PRINTER (OS203DT) format



When **Fort = 1,** Data format lists below (** there is a comma ",”between data and unit)：



When **Fort=2,** Data format lists below (** there is no comma ",”between data and unit)：



HEADER 1	HEADER 2	UNIT
OL：OVERLOAD	NT：NET WEIGHT	kg，lb
ST：STABLE	GS：GROSS WEIGHT	
US：UNSTABLE		

When **Fort=3,** the format of data is：Date/Time + Fort2 data format

When **Fort=4,** the format of data is for MINI PRINTER (16 columns) data format

When **Fort=5,** the format of data is for THERMAL PRINTER data format

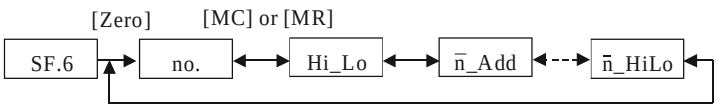
In Fort4、5, (when SF.4 setting is n̄_HiLo), the Sub-Menu can set print copies for each weight and total weight：

Prno. **à** Set Each Weight Copies
t_P.n. **à** Set Total Weight Copies

Note: After the setting of copies, if press "ESC" then the display shows E_prn, By pressing "MC" or "MR" to set the language as below

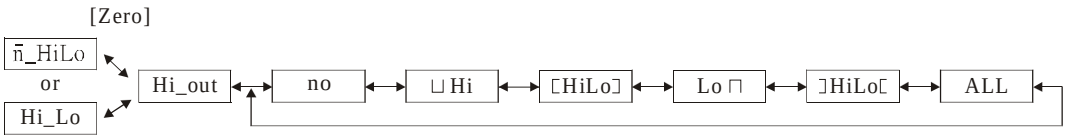
E_Prn **à** English Mode
C_Prn **à** Chinese Mode(BIG 5) (Only in Thermal Printer)
CC_Prn **à** Chinese Mode(GB)

3.1.6 OPERATION MODE SETUP: (default : n̄_HiLo)



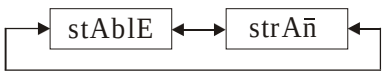
no.	Disable
Hi_Lo	Hi-Lo Check Mode
n_Add	Accumulation Mode
n_HiLo	Accumulation and Hi-Lo Check Mode

3.1.6.1 When the Operation Mode is in Hi_Lo and n̄_HiLo :



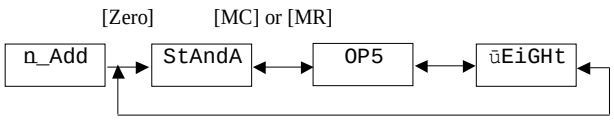
no.	Disable
⌴Hi	Output data when the weight is higher than "Hi"value
⌈HiLo⌋	Output data when the weight is between Hi and Lo
Lo⌐	Output data when the weight is lower than "Lo"value
⌋HiLo⌊	Output data when the weight is not between the Hi and Lo range
ALL	Output data anyway

After the Operation Mode is confirmed, the display shows Hi_mod



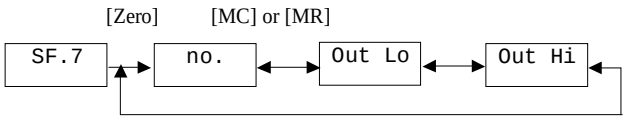
StrAn̄	Continuous check HI-OK-LO status
StAbLE	Check HI-OK-LO status after stable

3.1.6.2 When the Operation Mode is in n̄_Add or n̄_HiLo, Press "Zero" to enter to sub-menu to set the RS-232 format:



StAndA	RS-232 standard output format please see with Label Print section。
OP5	RS-232 output format (please see the format 2 in Section 3.1.5), it can connect to OP5 display board.
ūEiGHt	Only weight data can be sent.

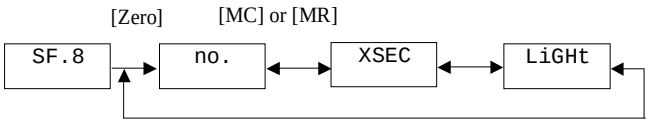
3.1.7 RELAY OUTPUT SETUP: (default = Out_Hi)



RELAY Output

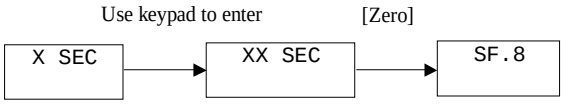
	Normality	Action
no	Disable	Disable
Out Lo	Relay output status is Close	Relay output status is Open
Out Hi	Relay output status is Open	Relay output status is Close

3.1.8 BACKLIGHT SELECTION: (default = 3 sec)

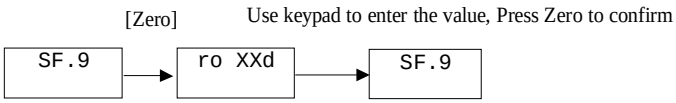


Backlight Select
no. : Backlight off
XSEC : Turn on the backlight for X seconds (Max = 20 sec)
LiGHt : Always turn on the backlight

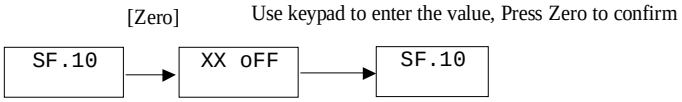
When the XSEC is selected, press the number keypad to enter the time setting and press "**Zero**" to confirm it.



3.1.9 RELAY OUTPUT ZERO RANGE SETUP: (default = 0)

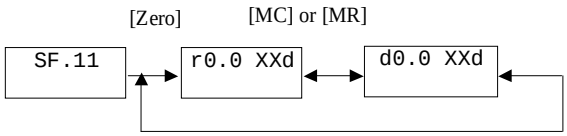


3.1.10 AUTO POWER OFF SETUP: (default = 30 min)



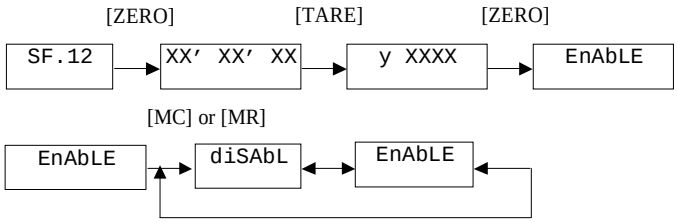
Set auto off time, Maximum time is 99 minutes.

3.1.11 AUTO ZERO TRACKING RANGE SETUP: (default = 0)



r0.0 XXd ：Within the setting range, the weight is forced to be zero (Max = 99 div)
d0.0 XXd ：Within the setting range, the display shows zero (but it does counting inside the program); when the weight is over the setting range, the display shows the actual weight.

3.1.12 DATE SETUP:

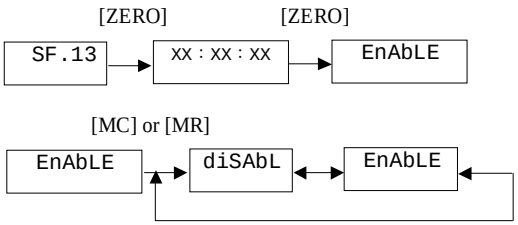


Format XX′ XX′ XX ： year / month / day (C.E.)

When the monitor shows XX′ XX′ XX, press〝TARE〞to set the year (EX. y 2003)。

EnAbLE：Print out Date with Data (default setting)
diSAbL ：Disable Date Print

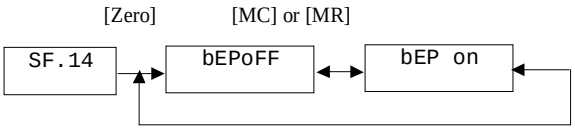
3.1.13 TIME SETUP:



Format XX：XX：XX ： hour / minute / second (24 hours format)

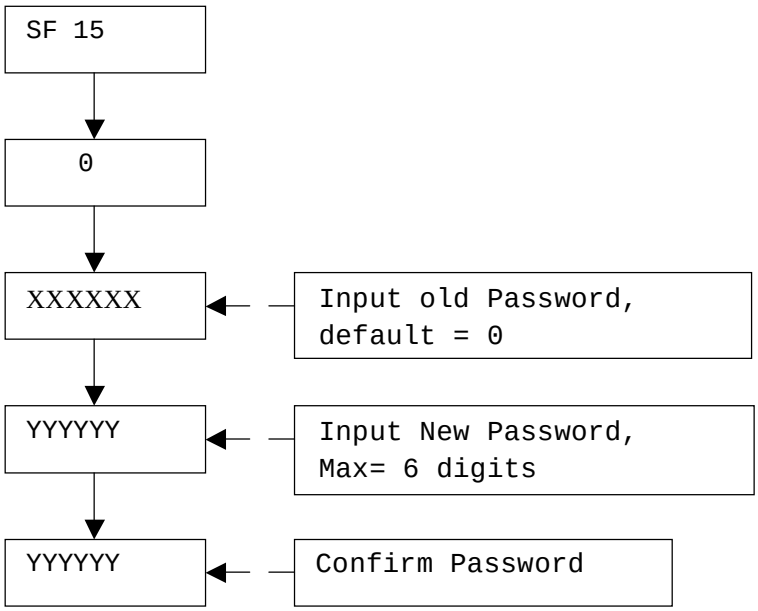
EnAbLE：Print out time with data. (default setting)
diSAbL ：Disable time print

3.1.14 BEEP MODE SETUP: (default = bEPoFF)



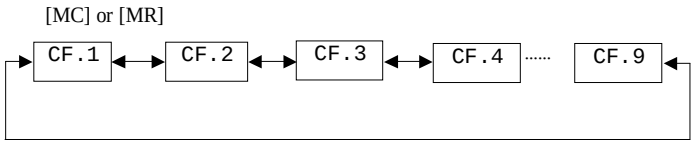
BEEP Mode Setting
bEPoFF ：Disable Beep
bEP on ：Beep

3.1.15 PASSWORD SETUP: (default = 0)



3.2 CALIBRATION AND PARAMETER SETUP:

NOTE: Press "**Tare**" and hold, then Press "**ON**" to enter the Calibration Setting mode (Press "**MR**" (up) or "**MC**" (down) "**ESC**" (abandon) "**Zero**" (confirm) to chose the menu：CF.1, CF.2, ….), Press "**Zero**" to enter to the each single feature for setting. If any mistake occurs during the procedure, press "**ESC**" to abandon the setting.



CF.1 -> CAPACITY & DIVISION SETUP
CF.2 -> CALIBRATION PROCEDURES
CF.3 -> WEIGHT CORRECTION (LINEARITY CORRECTION)
CF.4 -> DECIMAL POINT SETUP
CF.5 -> POWER ON WEIGHT UNIT SETUP
CF.6 -> ZERO TRACKING RANGE SETUP: (default = 1.5div / 1sec)
CF.7 -> POWER ON AUTO ZERO RANGE SETUP: (default = 0%)
CF.8 -> MANUAL ZERO RANGE SETUP: (default = 100%)
CF.9 -> MOTION DETECTION SETUP: (default = 1.0-0.5)

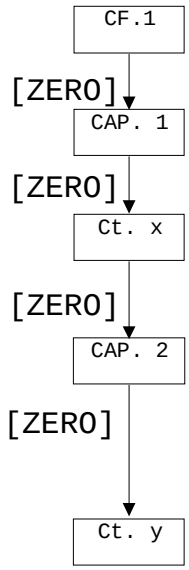
NOTE：

* 1. When password function disable, CF.1~CF.9 will not be allowed to access.

* 2. If indicator is protected by password, enter correct password in order to access this menu.

3.2.1 CAPACITY & DIVISION

1. Use KeyPad to enter the Capacity.
2. The decimal point and weight unit can be set in CAP.1 and CAP.2 by using "MR" and "MC".
3. Press "Zero" to confirm and enter to next step.
4. Press "MR" and "MC" to set the division



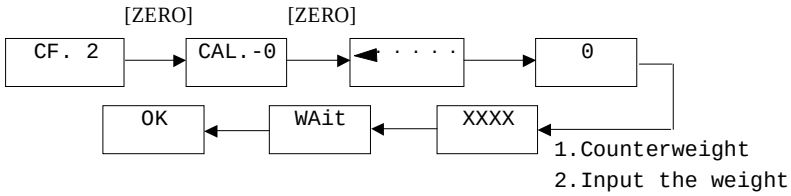
Maximum Capacity ◦ (Graduation / Maximum Capacity >= 1/30000)

Second Graduation. (1, 2, 5, 10, 20, 50, Notice: the accuracy = Minimum Graduation / Maximum Capacity =< 1/30000)

First Capacity. (extract a capacity between zero and max capacity. The indicator will use first graduation from zero to first capacity and use second graduation from first capacity to maximum capacity).
** If customers only need one graduation, press "zero" to escape.

First Graduation. (1, 2, 5, 10, 20, 50, Notice: the total divisions = Max1 / e1 + Max2 / e2 should not exceed 30,000)

3.2.2 CALIBRATION



Steps	Display
1. Enter to 〝CF.2〞	CF.2
2. Press [ZERO] key,The indicator will do the Zero Calibration 〝CAL.-0〞 (Please remember to remove the weight on the platform)	CAL-0
3. Press [ZERO] If it shows 〝 ◄ . . . . . 〞 , it means the Zero Calibrtion is successful.	◄ · · · ·
4. The display shows 〝0〞 Please key in the weight you would like to calibration.; The closer the counterweight to the maximum weight, the accurate the weighing result will be. XXXX：Please input the weight of the counterweight.	0
	XXXX
5. Put the counterweight on the platform. When it becomes stable, Press [ZERO] , If the display shows 〝WAit〞 and 〝OK〞 , it means the calibration is successful.	WAit
	OK

ERROR MESSAGES DURING CALIBRATION PROCESS

1. ZERO CALIBRATION:

When below error messages appear on the display, the zero calibration is invalid. Follow the steps to solve the problems.

Error Code： AAAAAA

a. Poor connection
  I. To check the connector wirings
b. Wrong connection
  I. To check SIG+ and SIG-
  II. To see if the polarity of signal is reversed.

c. The input offset voltage is too low (over -1.5mV)
 I. Parallel connect a resistor (100-500K ohm) between EXC + and SIG +
d. Load Cell is damaged
 I. To replace a new load cell

Error Code： **UUUUUU**

a. Poor or wrong connection
 I. To Check the connector wirings
b. The offset voltage is too high (over+2mV)
 I. The load cell capacity is too small or it is malfunction. Change new load cells with bigger capacity.
c. Load cell is damaged
 I. To replace a new load cell.
d. Thunderstorm damage
 I. Return to UWE agent for thorough inspection.

2. SPAN CALIBRATION

Error Code： **LLLLLL**

a. Wire Connection is reversed at SIG+ & SIG-
 I. Check the load cell connector to see if the polarity of signal is reversed.

b. The load cell receipting direction is wrong
 I. Check all load cells for correct installation.

Error Code： **CCCCCC**

a. The calibrate weight is too light
 I. The calibrate weight should be at least 100 times of the minimum division

Error Code： **------**

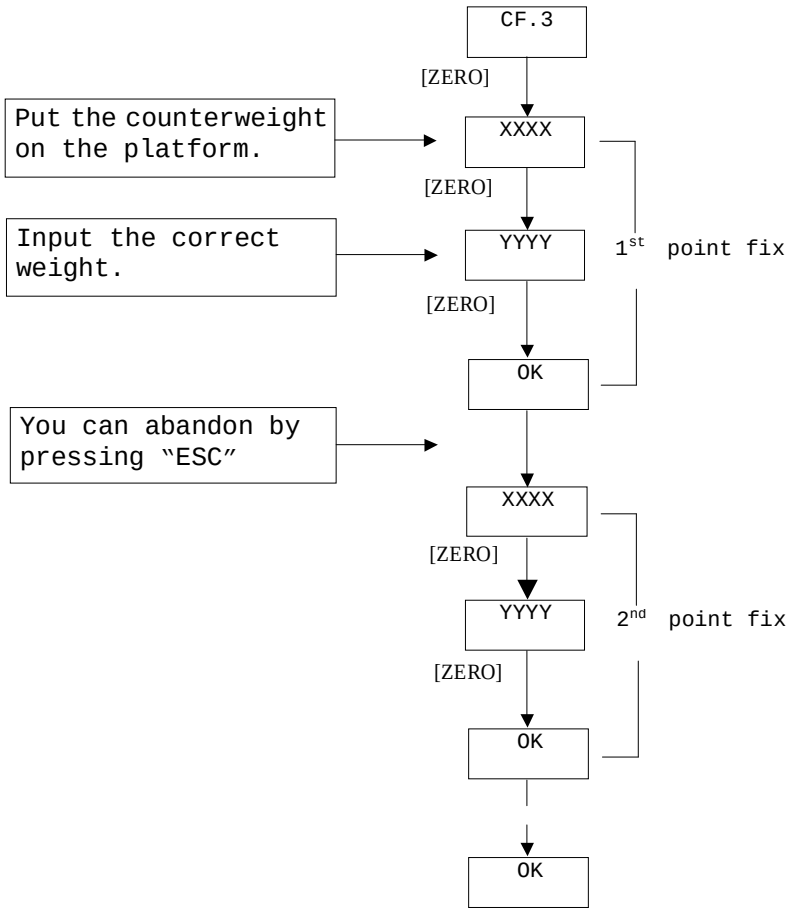
a. The output signal of load cell is inadequate for Span Calibration.
 I. To decrease the display resolution.
 II. To change load cells with lower capacity.

Error Code： **UUUUUU**

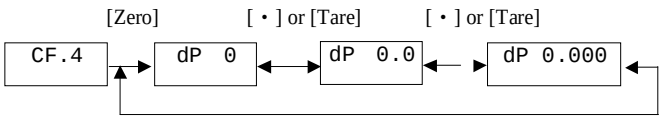
a. The span value is too high (more than + 15 mV)
 I.Replace new load cells with bigger capacities

3.2.3 WEIGHT CORRECTION (LINEARITY CORRECTION)

Enter to the CF.3, gradually adding counterweight on the platform. The indicator can fix the linear problem occurred by the Load Cell, It can fix up to 5 points.

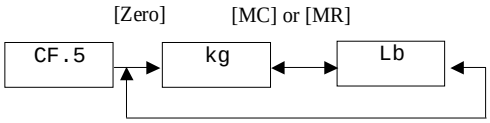


3.2.4 DECIMAL POINT SETUP:

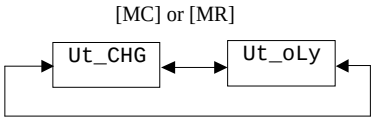


The decimal point is moved in sequence as 0, 0.0, 0.00, 0.000

3.2.5 POWER ON WEIGHT UNIT SETUP:

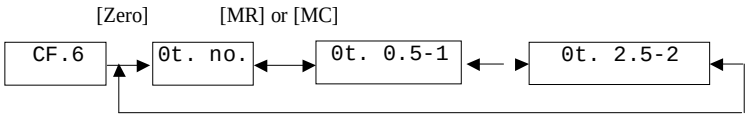


When the unit has been set, press "Zero" to confirm. The next step is to set the "**Unit Switch Button Menu**":



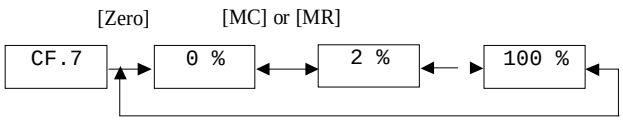
Ut_CHG	Press "Unit" to switch the weight unit
Ut_oLy	Can only use one unit.

3.2.6 ZERO TRACKING RANGE SETUP: (default = 1.5div / 1sec)



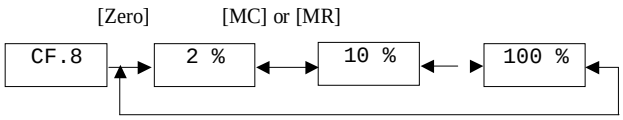
no. : Disable
0.5-1 : 0.5 div. / 1 sec.
1.0-1 : 1.0 div. / 1 sec.
1.5-1 : 1.5 div. / 1 sec.
2.0-1 : 2.0 div. / 1 sec.
2.5-1 : 2.5 div. / 1 sec.
0.5-2 : 0.5 div. / 2 sec.
1.0-2 : 1.0 div. / 2 sec.
1.5-2 : 1.5 div. / 2 sec.
2.0-2 : 2.0 div. / 2 sec.
2.5-2 : 2.5 div. / 2 sec.

3.2.7 POWER ON AUTO ZERO RANGE SETUP: (default = 0%)



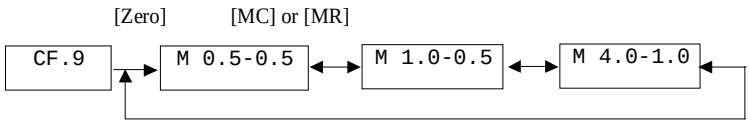
0 %
2 %
10 %
20 %
100 %

3.2.8 MANUAL ZERO RANGE SETUP: (default = 100%)



2 %
10 %
20 %
100 %

3.2.9 MOTION DETECTION SETUP: (default = 1.0-0.5)



0.5-0.5 : 0.5 div / 0.5 sec.
1.0-0.5 : 1.0 div / 0.5 sec.
2.0-0.5 : 2.0 div / 0.5 sec.
3.0-0.5 : 3.0 div / 0.5 sec.
4.0-0.5 : 4.0 div / 0.5 sec.
0.5-1.0 : 0.5 div / 1.0 sec.
1.0-1.0 : 1.0 div / 1.0 sec.
2.0-1.0 : 2.0 div / 1.0 sec.
3.0-1.0 : 3.0 div / 1.0 sec.
4.0-1.0 : 4.0 div / 1.0 sec.

3.3 PRINTTING LABEL FORMATS

3.3.1 Mini Printer (Built-in) (Internal)

(1) Parameter setup：

SF.4 → n̄_HiLo → n̄UL1 → n̄r_kEy

SF.5 → Fort 4 → XXX → Press "ESC" key till "SF.5"appears

SF.6 → Hi_Lo → no → StrAm or StAbLE (P.15 Section 3.1.6)

```
600.2kg  L
1200.5kg G
1799.6kg G
1799.6kg G
2400.8kg H
```

** Only print the receipt for weight and check weighing status.

(2) Parameter setup：

SF.4 → n̄_HiLo → n̄UL1 → n̄r_kEy

SF.5 → Fort 4 → Prno → Prno.1 (Set each time print Copies) [MC] → Prno. [MC] → t_P.n.1 (Set total weight prin copies) → t_P.n. → Press "ESC" key

SF.6 → n̄_Add → StAndA

** Customer can choose print copies for each label to be printed out and copies for total weight label to be printed out.

```
20003/09/17
17:45
P/No. ABC123
Ser.    1
N.W.  600.1kg
Tare
0.0kg
G..W.
600.1kg

20003/09/17
17:54
P/No. ABC123
Ser.    2
N.W.
1200.1kg
Tare
0.0kg
G..W.
1200.1kg
```

(3) Parameter setup：

SF.4 → n̄_HiLo → n̄uL1 → n̄r_kEy

SF.5 → Fort 3

SF.6 → n̄_HiLo → no → StrAm or StAbLE

(P.15 Section 3.1.6)

** Print weight receipt
(Time+Series+Weight+Checking Status+Total)

```
2003/04/23 16:05
P/No. AB-123
----------------
------------
Max：   32.0kg
Min：   12.0kg
----------------
------------
  01    10.0kg L
  02    20.0kg G
  03    30.0kg G
  04    35.0kg H
  05    20.0kg G
----------------
------------
  06    10.0kg L
----------------
```

(4) Parameter setup：

SF.4 → n̄_HiLo → n̄uL1 → n̄r_kEy

SF.5 → Fort 3

SF.6 → n̄_Add → StAndA

** Print weight receipt (Time+Series+Weight +Total)

```
20003/09/17
17:45
P/No. ABC123
--------------
-----------
--------------
-----------
01    599.9kg
02   1200.3kg
03   2400.6kg
04   3000.2kg
05   2400.5kg
--------------
-----------
--------------
-----------
Total  9601.5kg
```

(5) Parameter setup：

SF.4 → n̄_HiLo → n̄UL1 → n̄r_kEy

SF.5 → Fort 2

SF.6 → n̄_Add → StAndA

** Print weight receipt (Time+Series+Weight +Total)

** Print each weight and current accumulation weight data

```
20003/09/17
17:45
P/No. ABC123
--------------
-----------
--------------
-----------
06   599.9kg
     599.9kg
07   1200.3kg
     1801.2kg
08   2400.6kg
     4201.8kg
09   3000.2kg
     7202.0kg
```

(6) Parameter setup：

SF.4 → AVG_n̄d → n̄UL3 → StAbLE

SF.5 → Fort 4 → XXX→ Press"ESC″ until SF.5 appears

SF.6 → n̄_Add → StAndA

** Print weight receipt in health scale mode

```
2003/10/17 16:40
600.3kg

2003/10/17 16:40
1200.6kg
```

3.3.2 Thermo Printer (External Printer):

(1) Parameter setup：

SF.4 → n̄_HiLo → n̄uL1 → n̄r_kEy

SF.5 → Fort 5 → Prno → Prno.1 (Set each time print Copies) [MC] → Prno. [MC] → t_P.n.1 (Set total weight prin copies) → t_P.n. → Press "ESC" → E_Prn

SF.6 → n̄_HiLo → no → StrAm or StAbLE (P.15 Section 3.1.6)

** Customer can choose print copies for each label to be printed out and copies for total weight label to be printed out.

** English Label Format

```
20003/09/17 17:45
P/No. ABC123
SER.     1
N.W.   600.1kg
Tare     0.0kg
G..W.   600.1kg
```

```
20003/09/17 17:55
P/No. ABC123
SER.     2
N.W.   1200.1kg
Tare     0.0kg
G..W.   1200.1kg
```

```
20003/09/17 17:55
P/No. ABC123
Total    2
T  N.W. 1800.2kg
  Tare     0.0kg
T  G..W. 1800.2kg
```

(2) Parameter setup：

SF.4 → n̄_HiLo → n̄uL1 → n̄r_kEy

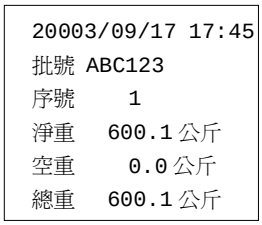
SF.5 → Fort 5 → Prno → Prno.1 (Set each time print Copies) [MC] → Prno. [MC] → t_P.n.1 (Set total weight prin copies) → t_P.n. → Press "ESC" → C_Prn

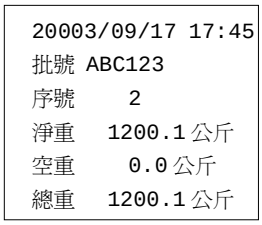
SF.6 → n̄_HiLo → no → StrAm or StAbLE

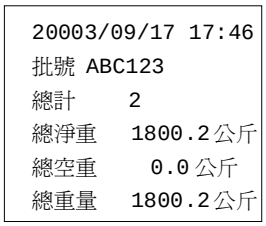
(P.15 Section 3.1.6)

** Customer can choose print copies for each label to be printed out and copies for total weight label to be printed out.

** Traditional Chinese Label Format







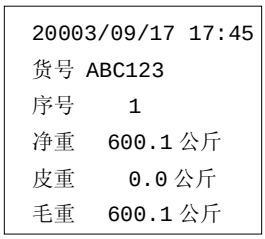
(3) Parameter setup：

SF.4 → n̄_HiLo → n̄uL1 → n̄r_kEy

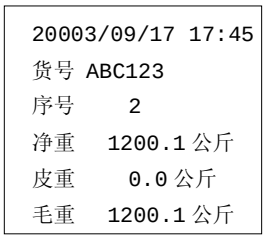
SF.5 → Fort 5 → Prno → Prno.1 (Set each time print Copies) [MC] → Prno. [MC] → t_P.n.1 (Set total weight prin copies) → t_P.n. → Press "ESC" → CC_Prn

SF.6 → n̄_HiLo → no → StrAm or StAbLE

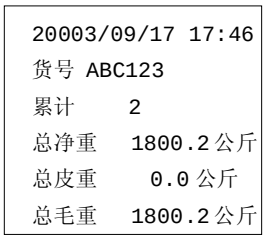
(P.15 Section 3.1.6)



** Customer can choose print copies for each label to be printed out and copies for total weight label to be printed out.



** Simplified Chinese Label Format

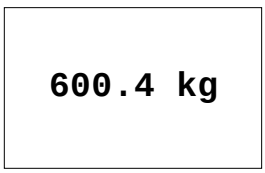


(4) Parameter setup：

SF.4 → StAbLE

SF.5 → Fort 5 → Prno → Prno.1 (Set each time print Copies) [MC] → Prno. [MC] → t_P.n.1 (Set total weight prin copies) → t_P.n. → Press "ESC" → E_Prn

SF.6 → no. → StArdA



** Only print the weighing data with enlarged font

(5) Parameter setup：

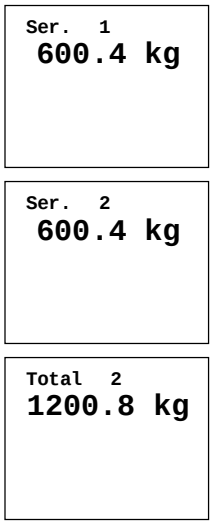
SF.4 → n̄_HiLo → n̄uL1 → n̄r_kEy

SF.5 → Fort 5 → Prno → Prno.1 (Set each time print

Copies) [MC] → Prno. [MC] → t_P.n.1 (Set total weight prin

copies) → t_P.n. → Press "ESC" → E_Prn

SF.6 → n̄_Add → StAndA



** Print the weight data with Enlarged font version and printed out the count for each individual label and total label number.

(6) Parameter setup：

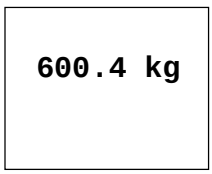
SF.4 → n̄_HiLo → n̄uL1 → n̄r _kEy

SF.5 → Fort 5 → Prno → Prno.1 (Set each time print

Copies) [MC] → Prno. [MC] → t_P.n.1 (Set total weight prin

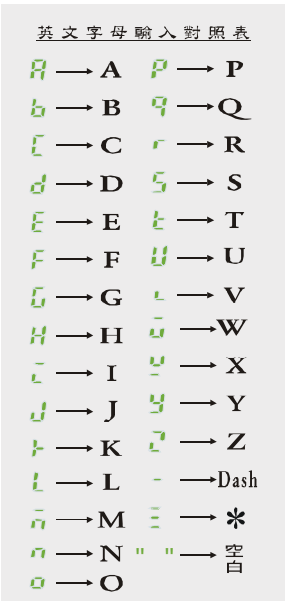
copies) → t_P.n. → Press "ESC" → E_Prn

SF.6 → Hi_Lo → strAm



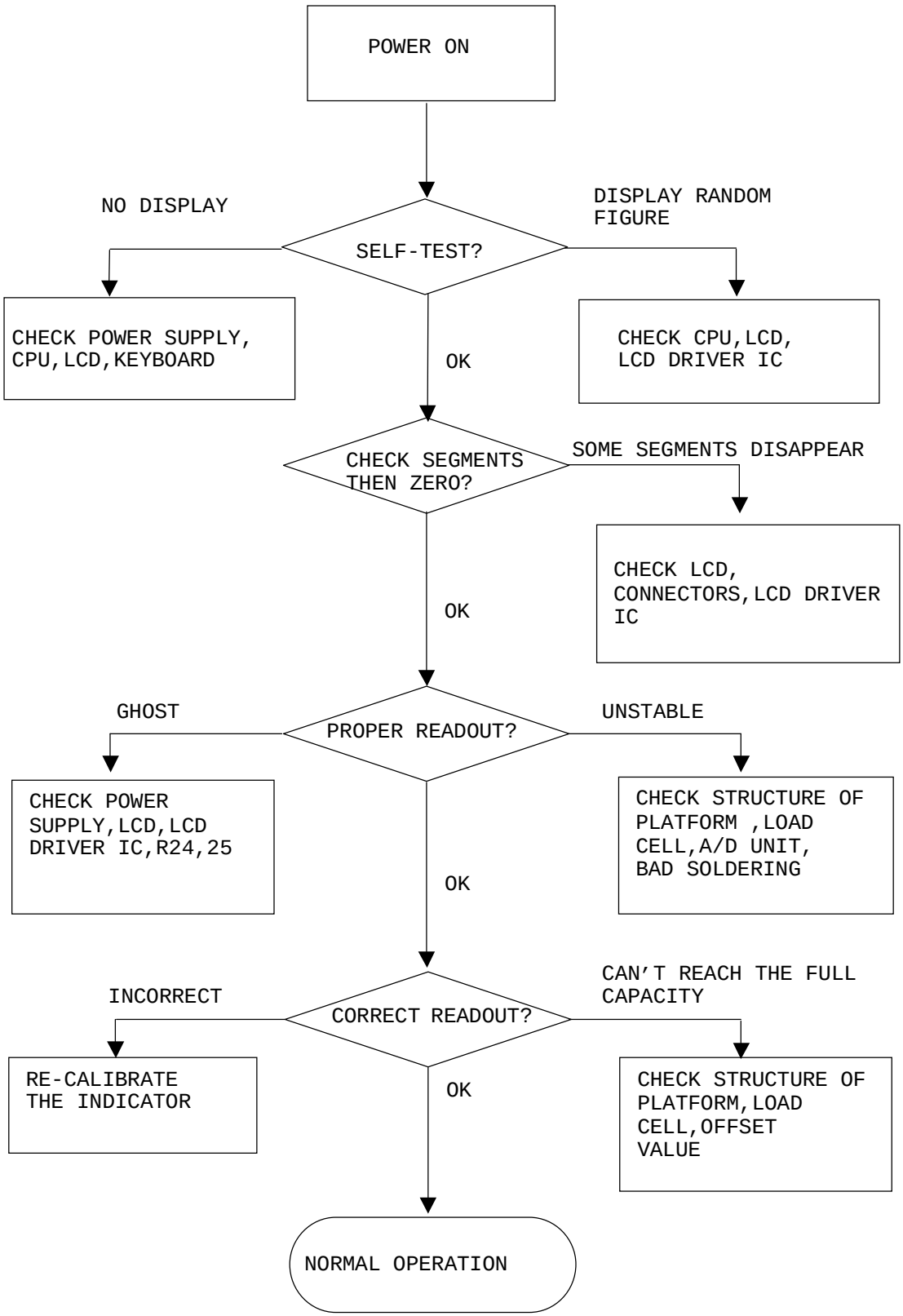
** Print the weight data in checking mode with enlarged font version

English alphabet contrast list (right picture)



4. TROUBLE SHOOTING

4.1 TROUBLE SHOOTING LOOP

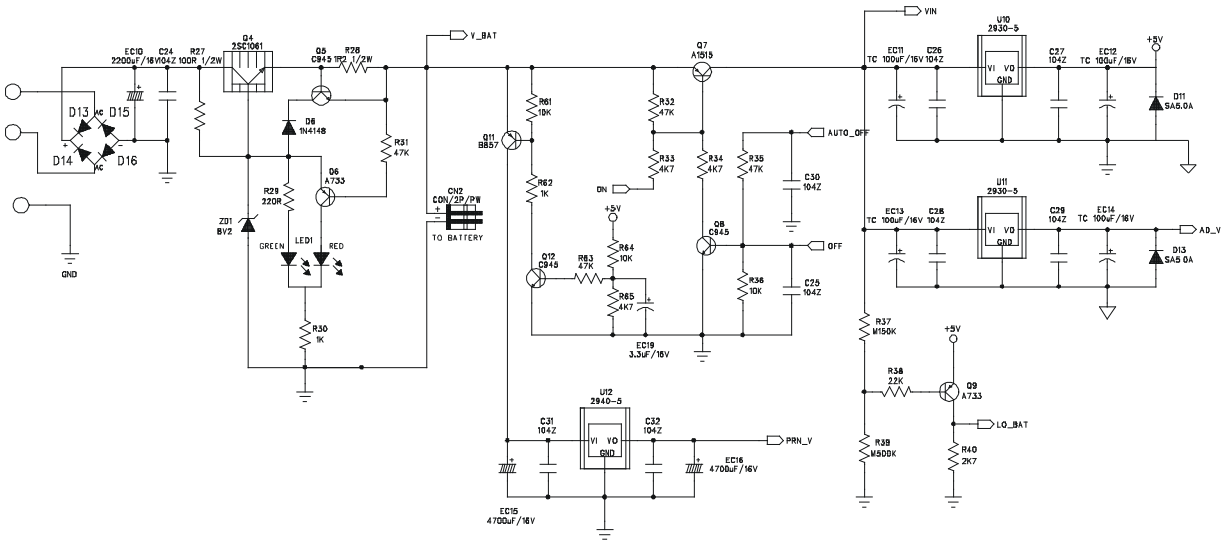


4.2 PARTS AND COMPONENTS TROUBLE SHOOTING

4.2.1 Power Supply Checking

4.2.1.1 Relevant parts:

Main Board (W22-10-X)
Q4 (C1061)
ZD1 (8.2V)
D13~D16 (1N4002)
Q7 (A1515)
Q5 (C945)
R28 (1.2 ohm, 1/2W)
U10 (2940-5V)
U11 (2940-5V)
U12 (2940-5V)
Q9 (A733)
DC JACK(SCD-021)



Description:

1) AC Adaptor: This AC Adaptor provides power of DC9~12V,500mA

2) Battery: Built-in Rechargeable Battery 6V/4Ah

3) How Battery is charged completely?
   The charging voltage is regulated by Q4 (C1061) and ZD1 (8.2V) for about 7 volts.
   The charging current will go down automatically when voltage reached.
   Q5 (C945) and R28 (1.2R, 1/2W) provide Over-Current protection.

4) +5VA power drives analog system including A/D converter device (IC 7730).
U11 (2940-5V) is a 5volts Voltage Regulator.

5) +5V power drives digital circuit systems.
U10 (2940-5V) is a 5volts Voltage Regulator.

6) Auto-off:
If the indicator is under LO-BAT situation, after fixed minutes, CPU will launch a high_to_low pulse to pull down the base pole of Q8(C945), then Q7 cuts off, the indicator will be shut down immediately.

7) Low Power Detection:
The Q9 (A733) is designed to detect the power level. When battery voltage is less than 5.5V, it will release a high potential signal to CPU, and then CPU will instruct LCD display to show LO-BAT symbol.

4.2.1.2 Input voltage: 5.5V or higher

Check and recharge battery if voltage less than 5.5V.
Check DC-JACK or AC Adaptor if been defective.

4.2.1.3 System voltage (Vcc): 5V +/- 10%

Check that the system voltage is within 5V +/- 10%
a) less than 4.5V, the CPU may not work properly.
b) more than 6V, ghost will appear on LCD.

4.2.2 Platform Structure Checking

The platter device shall not touch anything around itself during operation. Check that the platter is not contacted with the upper (no load) and/or lower (with load) stopper if equipped.

4.2.3 LCD Display Checking

4.2.3.1 Check that it is soldered and connected properly between LCD and driver IC (PCF8576), driver IC (PCF8576) and CPU.

4.2.3.2 Check whether LCD is broken.

4.2.4 CPU Checking

4.2.4.1 Check that all pins are seated properly into the socket.

4.2.4.2 Check that the Crystal Oscillator works.

4.2.4.3 Check the RESET is normally low.

4.2.5 A/D Unit Checking

4.2.5.1 Check that the +5VA power is correctly fed to the A/D unit.

4.2.5.2 Check that the signal output of load cell is adequate.

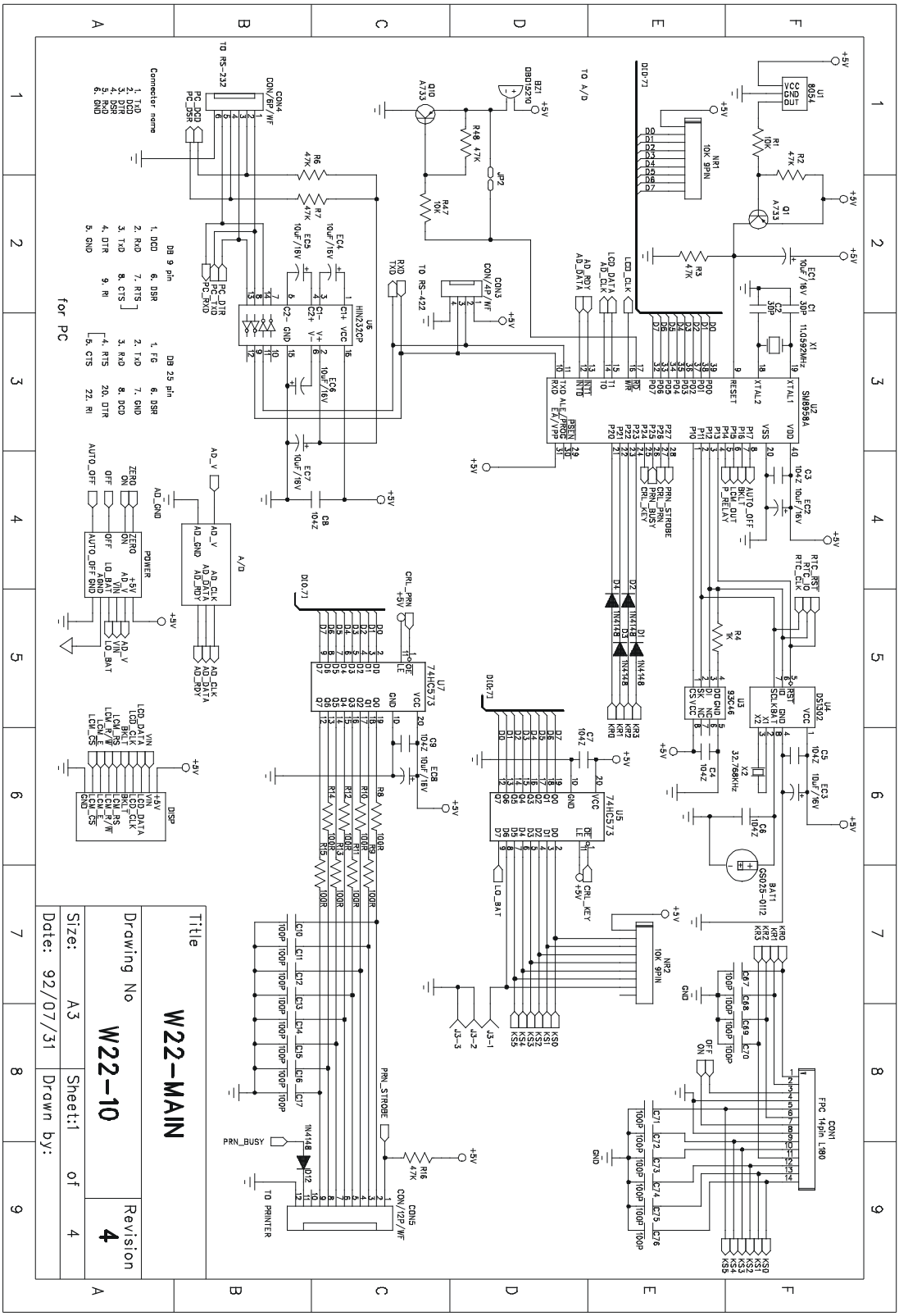
4.2.5.3 Check OP. amplifiers & A/D converter (AD7730).

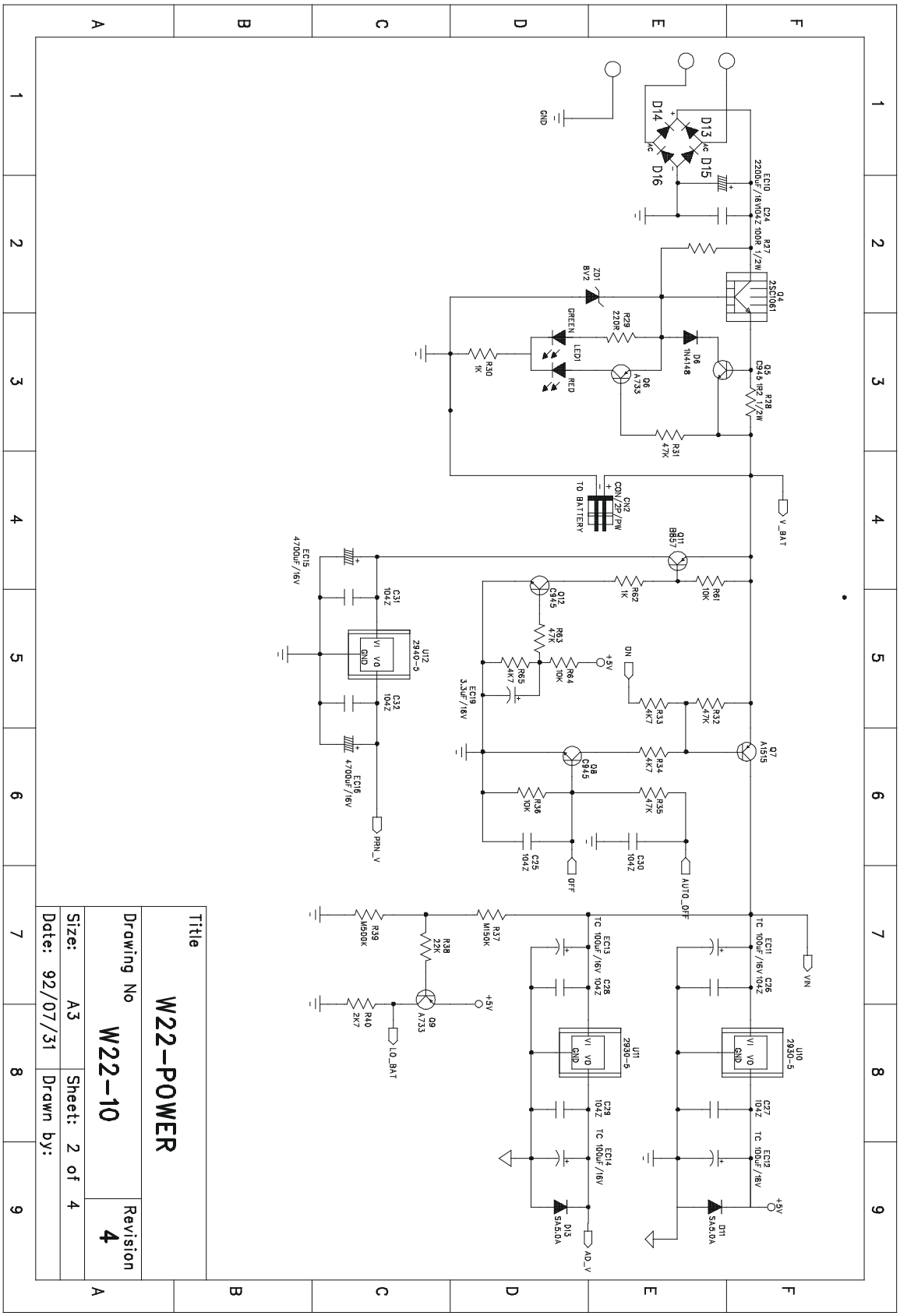
When no error is found with the above checking procedures, the trouble can be caused by the load cell or the PCB itself. Replace a new one could be better to identify the defectiveness.

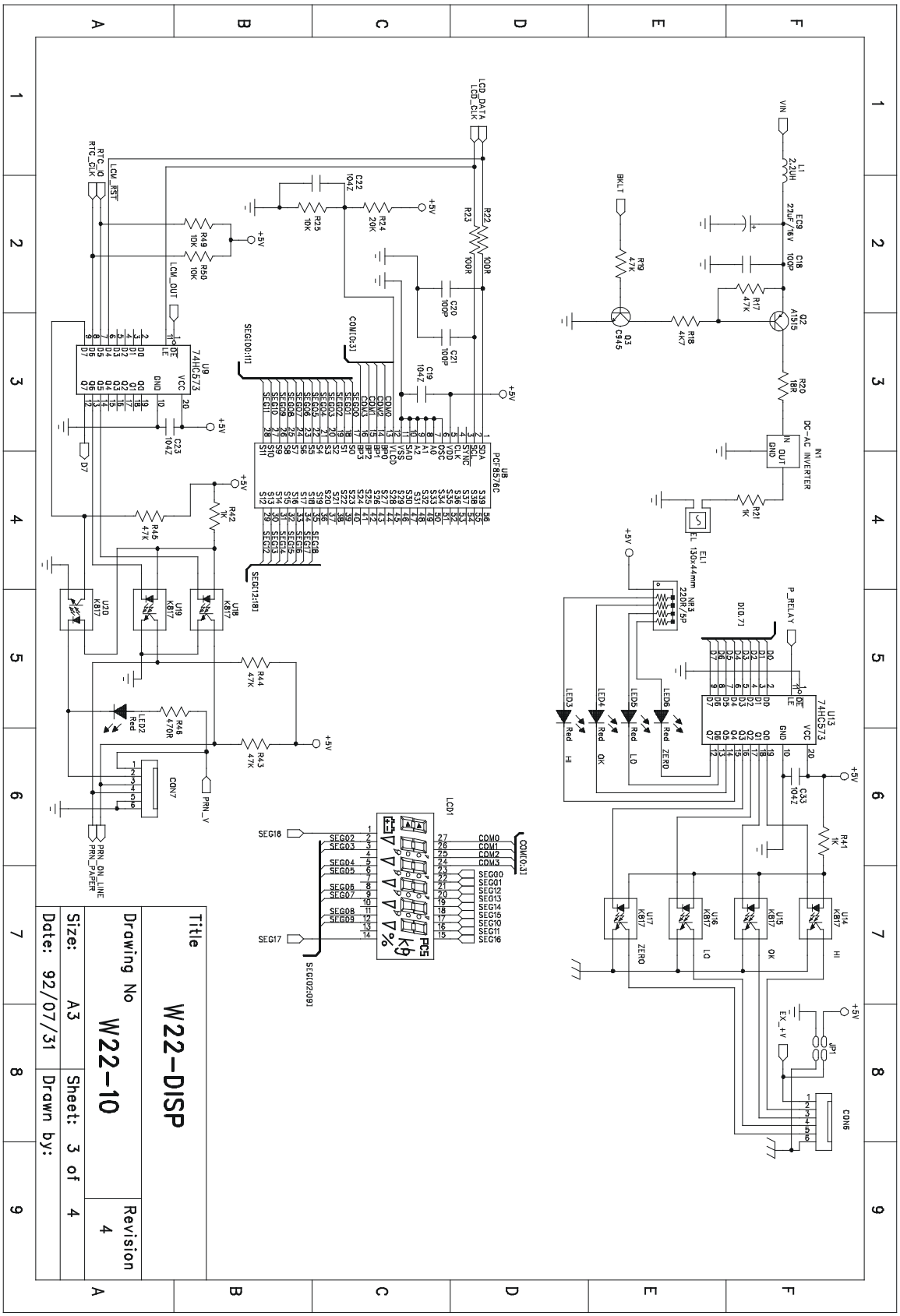
In this way, the readout of weight would be varied because of the output voltage of load cell gaining different span value, so re-calibration is necessary after this replacement.

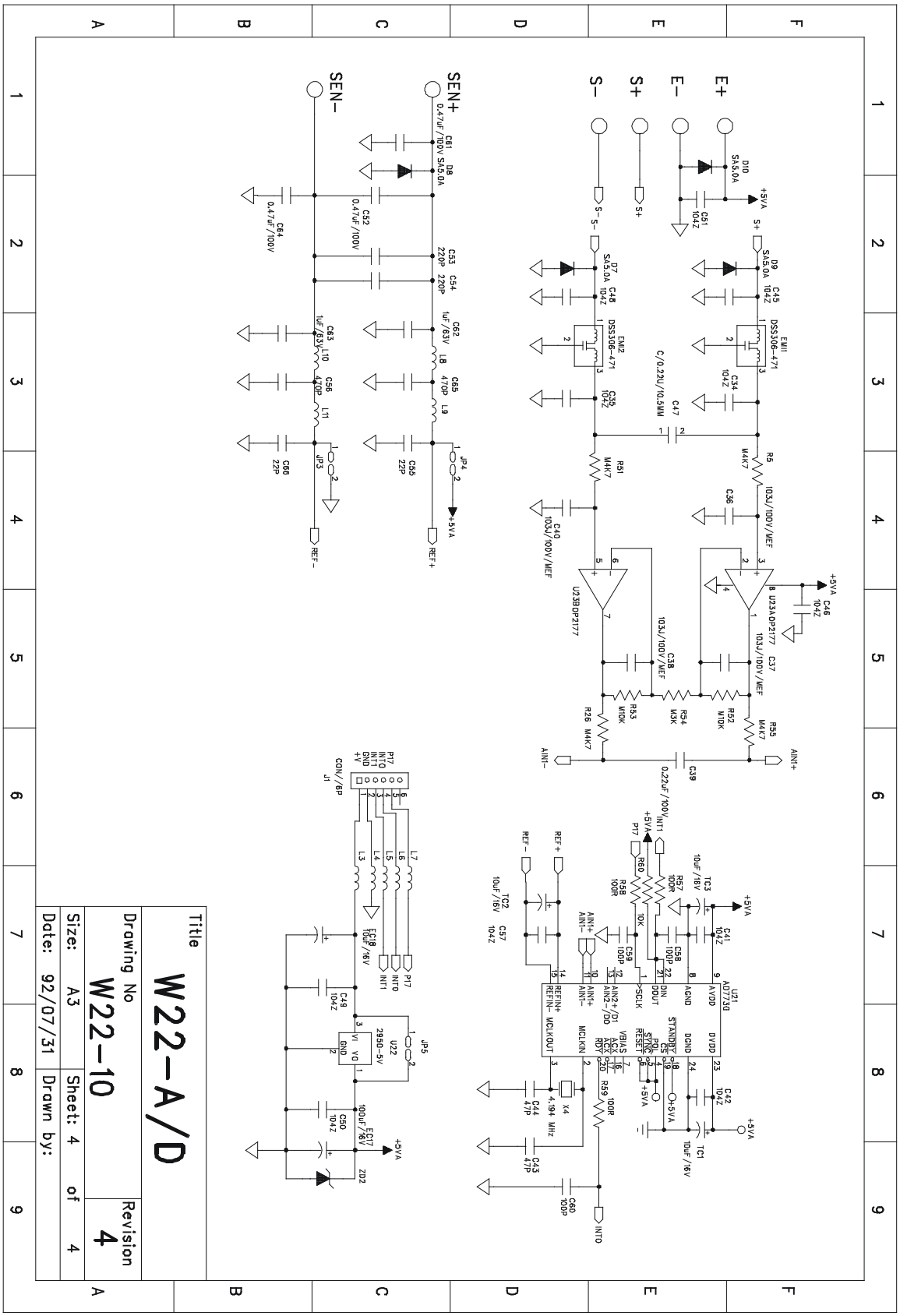
5. ELECTRICAL CIRCUITRY

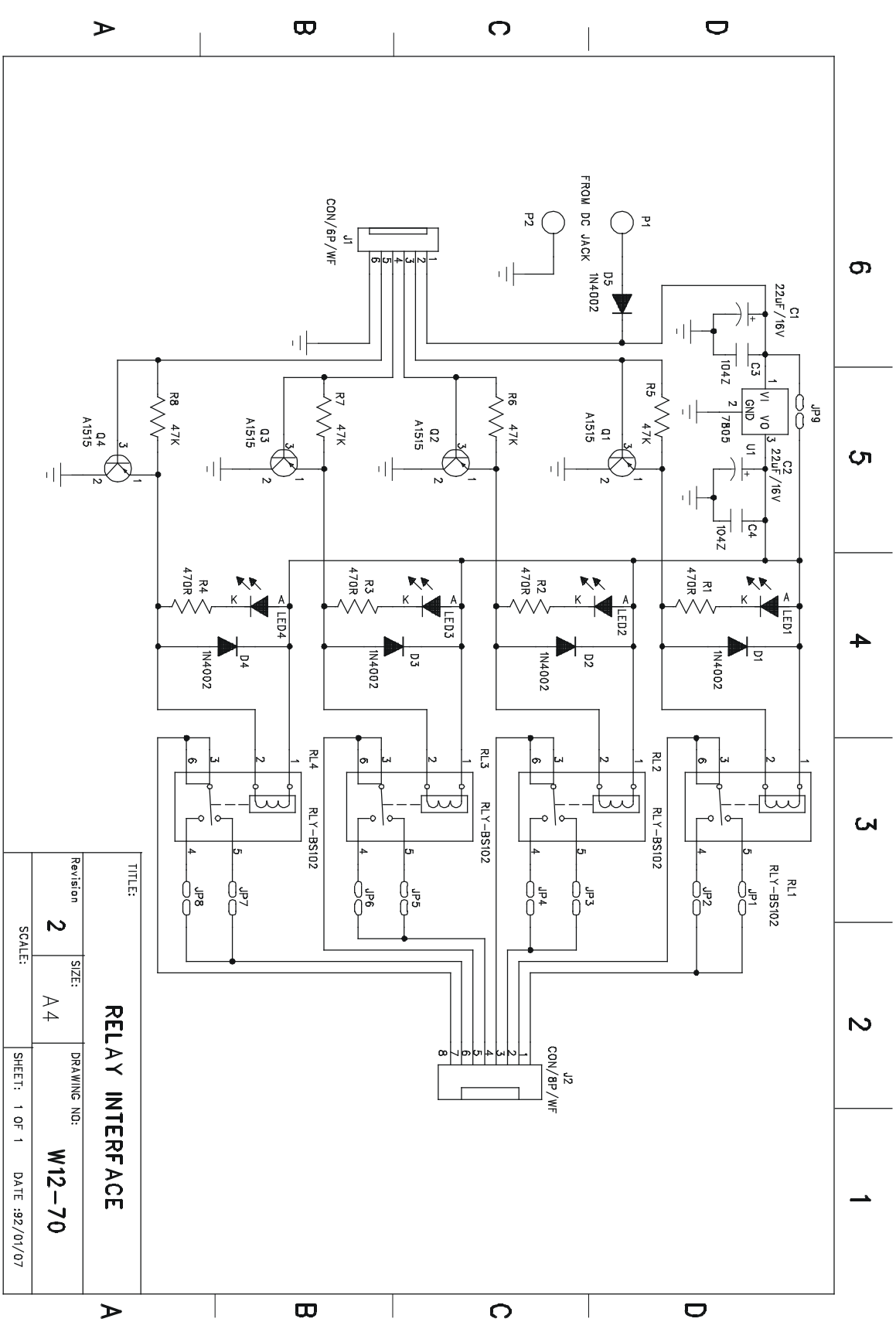
5.1 SCHEMATICS



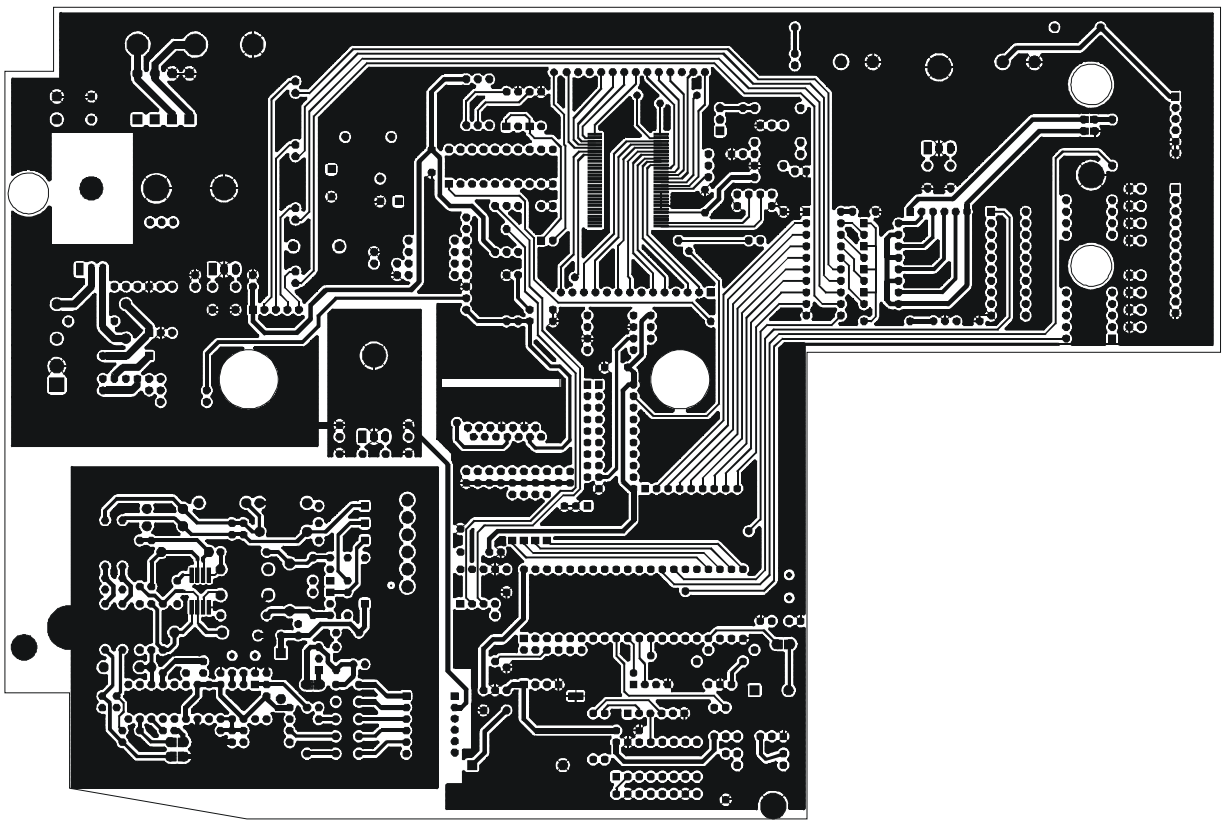

Title
W22-POWER
Drawing No
W22-10
Revision
4
Size: A3
Sheet: 2 of 4
Date: 92/07/31
Drawn by:
GND
D13
D14
D15
D16
EC10 2200uF/16V
C24 104Z
R37 10OR 1/2W
Q4 2SC1061
ZD1 8V2
R29 220R
GREEN
LED1
RED
D8 1N4148
R30 1K
Q6 A733
Q5 C945
R28 1K2 1/2W
R31 47K
CN2 CON/2P/PW
TO BATTERY
V_BAT
Q11 BB57
R62 1K
R61 10K
Q12 C945
R63 47K
R65 4K7
R64 10K
+5V
ON
EC19 3.3uF/16V
R33 4K7
R32 47K
Q7 A1515
Q8 C945
R34 4K7
R36 10K
R35 47K
C25 104Z
C30 104Z
OFF
AUTO_OFF
EC15 470uF/16V
C31 104Z
U12 2940-5
VI GND VO
C32 104Z
EC16 470uF/16V
PRN_V
R39 M500K
R37 M150K
R38 22K
Q9 A733
R40 2K7
LO_BAT
+5V
EC13 TC 100uF/16V
C28 104Z
U11 2930-5
C29 104Z
EC14 TC 100uF/16V
D13 SA5.0A
AD_V
VIN
EC1! TC 100uF/16V
C26 104Z
U10 2930-5
C27 104Z
EC12 TC 100uF/16V
+5V
D11 SA5.0A


Title
W22-DISP
Drawing No
W22-10
Revision
4
Size: A3
Sheet: 3 of 4
Date: 92/07/31
Drawn by:

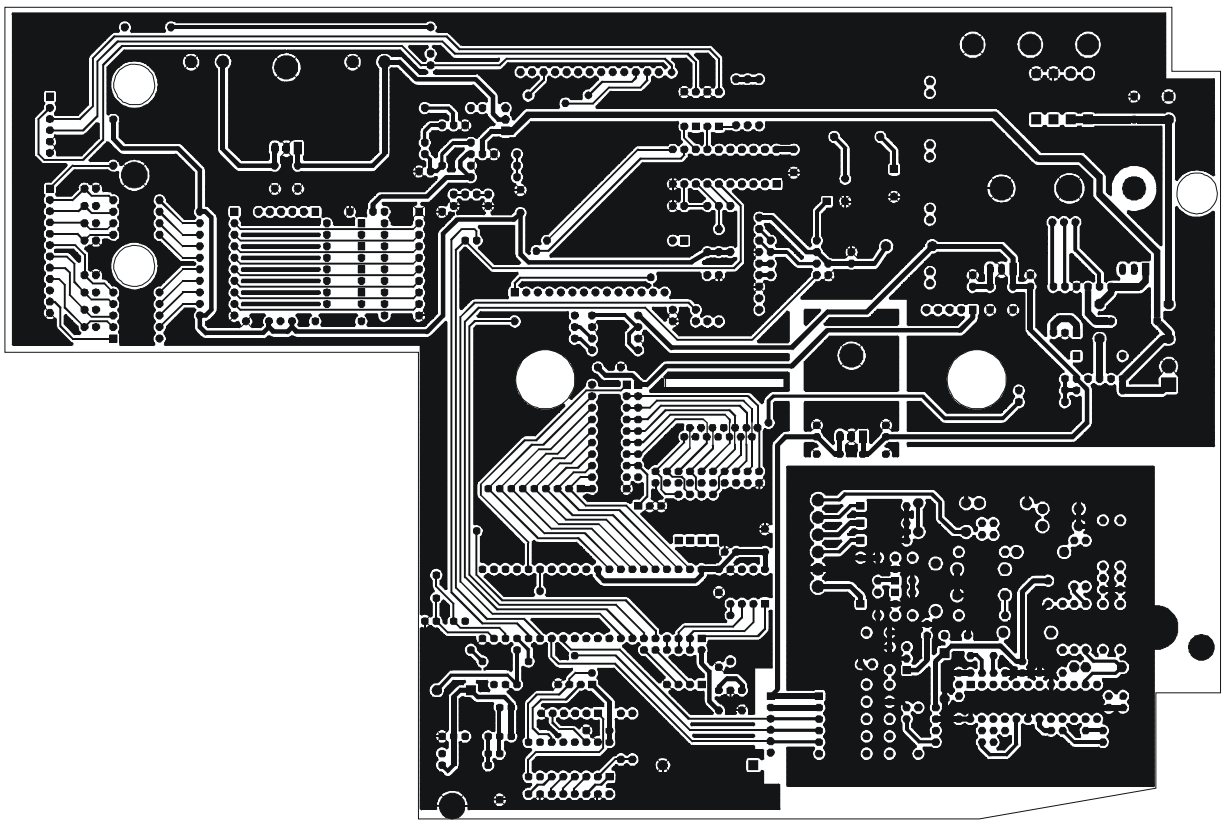

Title
W22-A/D
Drawing No
W22-10
Revision
4
Size: A3
Sheet: 4 of 4
Date: 92/07/31
Drawn by:
E+
E-
S+
S-
SEN+
SEN-
+5VA
AIN+
AIN-
REF+
REF-
INT0
INT1
U23A OP2177
U23B OP2177
AD7730
X4 4.194 MHz
CON/6P
U22 2950-5V


TITLE:
RELAY INTERFACE
Revision
2
SIZE:
A4
DRAWING NO:
W12-70
SCALE:
SHEET: 1 OF 1
DATE :92/01/07
FROM DC JACK
P1
P2
D5
1N4002
J1
CON/6P/WF
C1
22uF/16V
C3
104Z
U1
7805
C2
22uF/16V
C4
104Z
JP9
R1
470R
R2
470R
R3
470R
R4
470R
R5
47K
R6
47K
R7
47K
R8
47K
LED1
LED2
LED3
LED4
D1
D2
D3
D4
1N4002
Q1
A1515
Q2
A1515
Q3
A1515
Q4
A1515
RL1
RL2
RL3
RL4
RLY-BS102
JP1
JP2
JP3
JP4
JP5
JP6
JP7
JP8
J2
CON/8P/WF

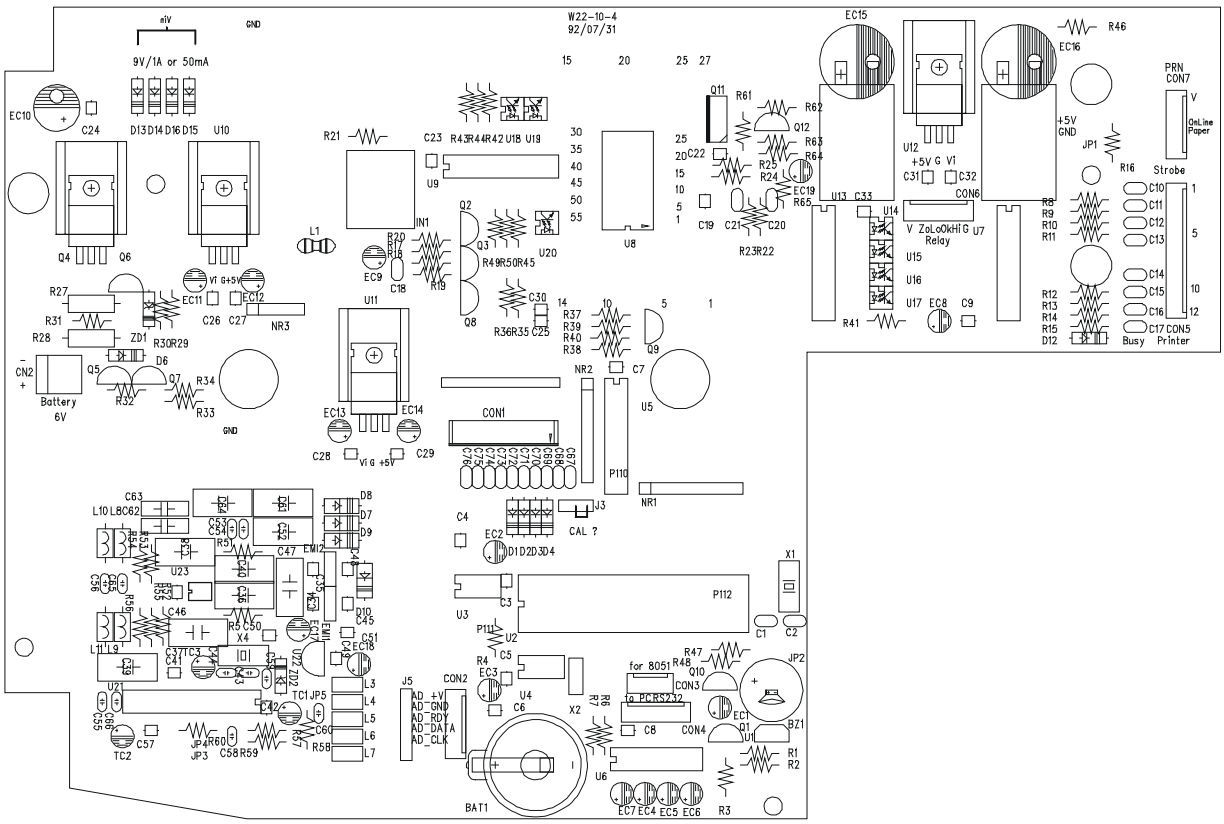
5.2 PCB LAYOUT



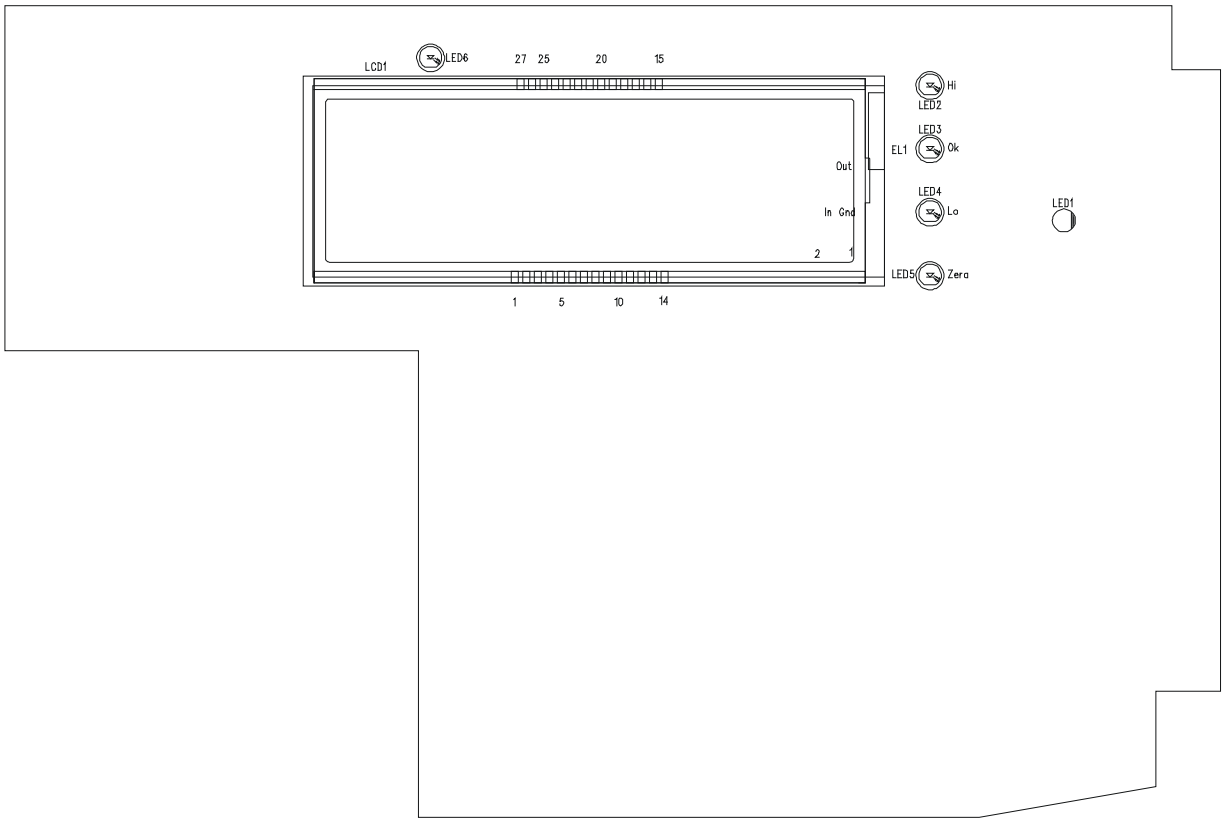
W22-10-4 TOP LAYER



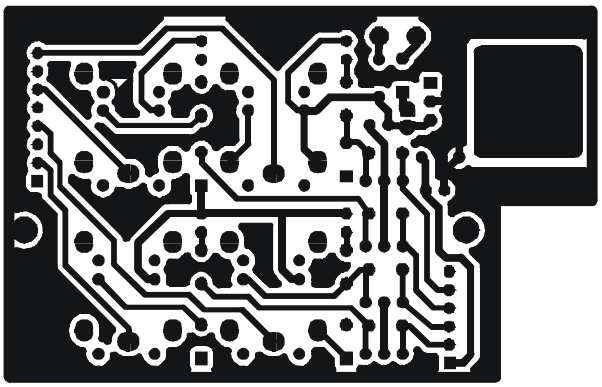
W22-10-4 BOTTOM LAYER



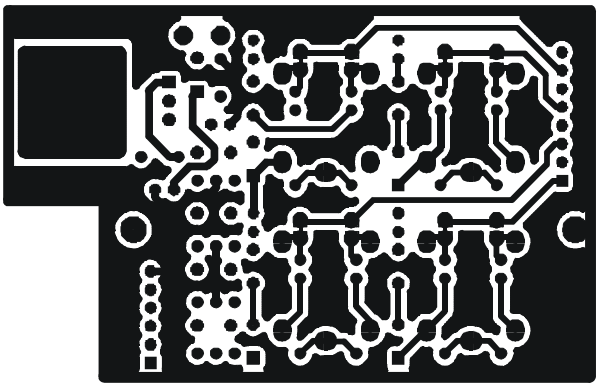
W22-10-4 TOP OVERLAY



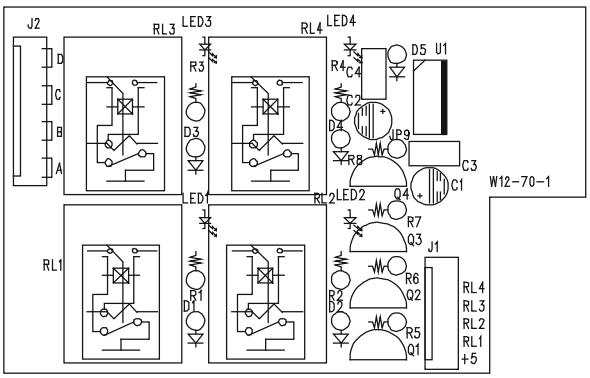
W22-10-4 BOTTOM OVERLAY



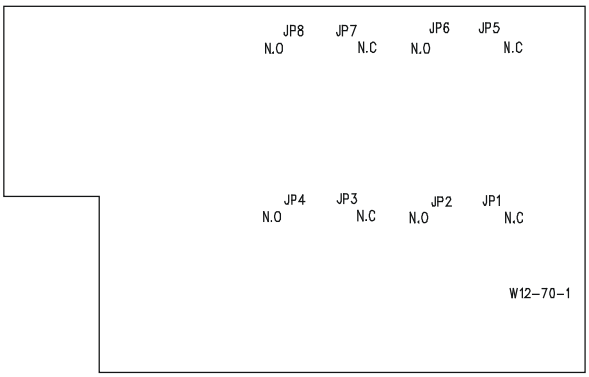
W12-70-1 TOP LAYER



W12-70-1 BOTTOM LAYER



W12-70-1 TOP OVERLAY



W12-70-1 BOTTOM OVERLAY

6. BILL OF MATERIAL

STRUCTURE

Parts No.	Description	Specification	Qty	Remark
A0905600800	CONNECTOR	PLT-168-R	1	
A0905600801	CONNECTOR	PLT-168-P	1	
A0906000210	D.C. JACK	SCD-021	1	
A1202060251	WIRE ARRAY	6PIN 25cm(SINGLE HOUSING)	1	
A1208020351	BATTERY WIRE ARRAY	2PIN 35cm(SINGLE HOUSING)	1	
A1207060250	CABLE	2464#24,6PIN 25cm	1	
A1600060400	RECHARGEABLE BATTERY	GP4-6/6V 4Ah	1	
A60********	ADAPTOR	***V/9V 500mA	1	
B0W22000000	MEMBRANE SW.	W22 SERIES(24 KEY)	1	
C1W22030001	PANEL OVERLAY	W22 SERIES	1	
C1W22031000	KEYBOARD OVERLAY	W22 SERIES	1	
E9W22000030	P.C.B. KIT	W22-10-X	1	
F0007NBS102	S/S BATTERY CLAMP	NBS SERIES	1	
G0001T01000	INDICATOR HOUSING(UNDER)	T SERIES,COATING	1	
G0001T01100	INDICATOR HOUSING(UPPER)	T SERIES,COATING	1	
G0001T00101	PLASTIC COVER	MINI PRINTER	1	
G0004DW0001	RUBBER PAD	DW SERIES, ϕ16*3.5t	4	
A1007000004	FERRITE CORE	T-28.3*13.8*13.5mm	1	
A1007000011	FERRITE CORE	19*6.5*32mm,CLAMP TYPE	1	
A1204010150	CONDUCTIVE WIRE	15cm, BLACK	1	
A1204020800	WIRE ARRAY	2PIN 80cm(0.18/30)	1	
A0750122050	CAPACITOR(CCFT)	1200pF/50V	4	
A0904120090	CONNECTOR	D-SUB 09F SOLDER	1	

W22-10-X MAINBOARD

E0W22000011	P.C.B.	W22-10-X	1	
A0202093462	I.C.	93C46PC27 OR 93LC46	1	U3
A0206022770	I.C.	OPA2277UA[BURR-BROWN]	1	U23
A0203077300	I.C.	AD7730BN	1	U21
A0204745732	I.C.	74HC573	4	U5,7,9,13
A0207029400	VOLTAGE REGULATOR I.C.	LM2940CT-5	3	U10-12
A0250013020	I.C.	DS1302	1	U4
A0208085760	I.C.	PCF8576CT	1	U8
A0201089516	I.C.	SM89516AC25P	1	U2
A0250080540	I.C.	S80745AL OR S80845CLY-B	1	U1
A0300000016	I.C. SOCKET	16 PIN	1	U6
A0300000040	I.C. SOCKET	40 PIN	1	U2
A0102000292	L.C.D	054821-1, 6 DIGITS	1	LCD1
A0401007150	TRANSISTOR	A715	1	Q11
A0401007330	TRANSISTOR	2SA733	3	Q1,6,9
A0401009450	TRANSISTOR	2SC945	4	Q3,5,8,12
A0401010610	TRANSISTOR	H1061C OR D880	1	Q4
A0401015150	TRANSISTOR	A1515	2	Q2,Q7
A0403008170	PHOTO COUPLER	K817P	3	U18-20
A0501004002	DIODE	1N4002	4	D13-16
A0501004148	DIODE	1N4148	6	D1-4,D6,12
A0503020082	ZENER DIODE	1/2W 8V2(9A3)	2	ZD1,2
A0625050000	L.E.D.	ROUND,5mm,(RED,GREEN)	1	LED1
A0701106017	CAPACITOR (EC)	10uF/25V（SS TYPE）	9	EC1-9

A0701107016	CAPACITOR (EC)	100uF/16V	4	EC11-14
A0701227017	CAPACITOR (EC)	220uF/16V(SS TYPE)	2	EC17-18
A0701228016	CAPACITOR (EC)	2200uF/16V	1	EC10
A0701476016	CAPACITOR (EC)	47uF/16V	1	EC19
A0701478016	CAPACITOR (EC)	4700uF/16V	2	EC15-16
A0702106016	CAPACITOR (TC)	10uF/16V(106)	3	TC1-3
A0713103251	CAPACITOR (MEF)	0.01uF/250V	4	C36-38,40
A0713105064	CAPACITOR (MEF)	1uF/63V(105)(7.5mm)	1	C39
A0713224101	CAPACITOR (MEF)	0.22uF/100V(224)	1	C47
A0730104050	CAPACITOR (MLC)	104Z	27	C3-9,19,22 23-33,41-42 46,49-51,57
A0731104050	CAPACITOR (X7R)	0.1uF/50V(104)	4	C34-35,45, 48
A0740030050	CAPACITOR (CC)	30pF/50V(30)	2	C1-2
A0740047050	CAPACITOR (CC)	47pF/50V(47)	2	C43,44
A0740101050	CAPACITOR (CC)	100pF/50V(101)	24	C10-18,20, 21,67-76, 58-60
A0802010205	RESISTOR NETWORK	1KΩ 5 PIN	1	NR3
A0802010309	RESISTOR NETWORK	10KΩ 9 PIN	2	NR1-2
A0803041002	METAL FILM RESISTOR	10KΩ 1/4W(10PPM)	2	R52,53
A0803043001	METAL FILM RESISTOR	3KΩ 1/4W(10PPM)	1	R54
A0804041503	METAL FILM RESISTOR	150KΩ 1/4W(25PPM)	1	R37
A0804044701	METAL FILM RESISTOR	4.7KΩ 1/4W(25PPM)	2	R5,26
A0804044702	METAL FILM RESISTOR	47KΩ 1/4W(25PPM)	2	R55,56
A0804045003	METAL FILM RESISTOR	500KΩ 1/4W(25PPM)	1	R39
A0805020120	CARBON FILE RESISTOR	1.2Ω 1/2W	1	R28
A0805021101	CARBON FILE RESISTOR	100Ω 1/2W	1	R27
A0805041101	CARBON FILE RESISTOR	100Ω 1/4W	13	R8-15,22-23 ,57-59
A0805041102	CARBON FILE RESISTOR	1KΩ 1/4W	6	R4,21,30,34 ,41-42
A0805041103	CARBON FILE RESISTOR	10KΩ 1/4W	7	R1,25,36,49 ,50,60-61
A0805041180	CARBON FILE RESISTOR	18Ω 1/4W	1	R20
A0805041203	CARBON FILE RESISTOR	20KΩ 1/4W	1	R24
A0805041221	CARBON FILE RESISTOR	220Ω 1/4W	2	R29,62
A0805041223	CARBON FILE RESISTOR	22KΩ 1/4W	1	R38
A0805041272	CARBON FILE RESISTOR	2.7KΩ 1/4W	1	R40
A0805041471	CARBON FILE RESISTOR	470Ω 1/4W	1	R46
A0805041472	CARBON FILE RESISTOR	4.7KΩ 1/4W	5	R18,33,63, 64-65
A0805041473	CARBON FILE RESISTOR	47KΩ 1/4W	13	R2-3,6-7, 16-17,19, 31-32,35, 43-45
A0901010040	CONNECTOR	4 PIN WAFER	1	CON3
A0901010060	CONNECTOR	6 PIN WAFER	2	CON4,7
A0901010120	CONNECTOR	12 PIN WAFER	1	CON5
A0902010020	CONNECTOR	2 PIN WAFER,PITCH=3.9mm	1	CN2
A0907010030	PIN PLUG	1 x 3 PIN 180°	1	J3
A0910000140	CONNECTOR(FPC)	14 PIN 180°	1	CON1
A0910100130	SOCKET STRIP	SIP, 1 x 13(FEMALE)	1	LCD1

A0910100140	SOCKET STRIP	SIP, 1 x 14(FEMALE)	1	LCD1
A1002225000	INDUCTOR	2.2uH	1	L1
A1008000001	EMI FILTER	DSS306-55Y5S471M100	2	EMI1-2
A1008000011	LINE FILTER	SB4515-600	5	L3-7
A1100032768	CRYSTAL	32.768KHZ	1	X2
A1100249153	CRYSTAL	4.9152MHZ/us	1	X4
A1100311060	CRYSTAL	11.0952MHZ/us	1	X1
A1400000006	BACK LIGHT	130.0*44mm	1	EL1
A1401005000	BACK LIGHT INVERTER	5V/90cm^2	1	IN1
A1500000004	BUZZER	OBO-15210	1	BZ1
A5004000002	HEAT SINK	MB-204-20	4	Q4,U10-12
A5008000002	BATTERY HOLDER	2032	1	BAT1
A1602030000	BUTTON BATTERY(3V)	CR2032	1	BAT1
A0203002322	I.C.	MAX232CPE	1	U6
F0015000014	A/D PROTECTION BOX	79*68*12（UPPER）	1	
F0015000015	A/D PROTECTION BOX	79*68*3 (UNDER)	1	
A0602050001	L.E.D.(SUPER BRIGHT)	RED,ROUND,§5	3	LED2,5,6
A0604050001	L.E.D.(SUPER BRIGHT)	YELLOW,ROUND,§5	1	LED4
A0605050000	L.E.D.(SUPER BRIGHT)	GREEN,ROUND,§5	1	LED3

OPTIONAL MINI PRINTER

A9001000017	MINI PRINTER SET	UP-A16P	1	
A1202060151	WIRE ARRAY	6PIN 15cm(DUAL HOUSING)	1	CON7
A1202120101	WIRE ARRAY	12PIN 10cm(SINGLE HOUSING)	1	CON5

OPTIONAL EXTERNAL PRINTER INTERFACE

A1250251240	WIRE ARRAY+DSUB25	12PIN 40cm(SINGLE HOUSING)	1	CON5

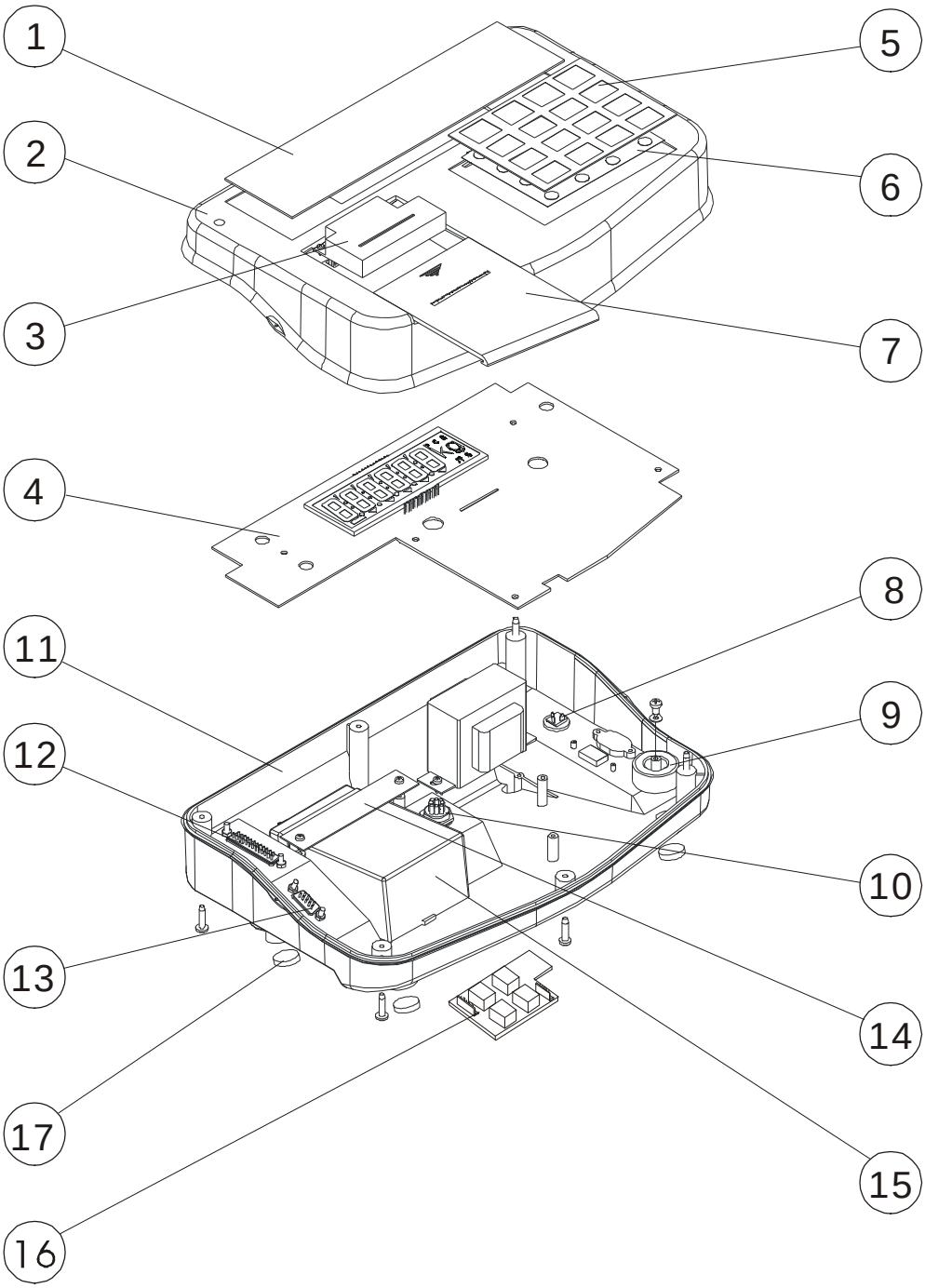
W12-70-X RELAY OUTPUT

E1W12100000	P.C.B. KIT	W12-70-X	1	
A1202060300	WIRE ARRAY	6PIN 30cm(DUAL HOUSING)	1	
A1202090380	WIRE ARRAY	9PIN 38cm(DUAL HOUSING)	1	
A5005000084	TERMINAL BLOCK	DT-25-A02W-04	2	

==========

7. APPENDIX

PARTS EXPLOSION:



ITEM	QTY	PART NO.	PART NAME	DESCRIPTION
1	1	C1W22030001	PANEL OVERLAY	W22 SERIES
2	1	G0001T01100	INDICATOR HOUSING(UPPER)	T SERIES,COATING
3	1	A9001000017	MINI PRINTER SET	UP-A16P
4	1	E9W22000030	P.C.B. KIT	W22-10-X
5	1	C1W22031000	KEYBOARD OVERLAY	W22 SERIES
6	1	B0W22000000	MEMBRANE SW.	W22 SERIES(24 KEY)
7	1	G0001T00101	PLASTIC COVER	MINI PRINTER
8	1	A0906000210	D.C. JACK	SCD-021
9	1	A1007000004	FERRITE CORE	T28.3*13.8*13.5mm
10	1	A0905600800	CONNECTOR	PLT-168-R
11	1	G0001T01000	INDICATOR HOUSING(UNDER)	T SERIES,COATING
12	1	A1250251240	WIRE ARRAY+DSUB25	12PIN 40cm(SINGLE HOUSING)
13	1	A0904120090	CONNECTOR	D-SUB 09F SOLDER
14	1	F0007NBS102	S/S BATTERY CLAMP	NBS SERIES
15	1	A1600060400	RECHARGEABLE BATTERY	GP4-6/6V 4Ah
16	1	E1W12100000	P.C.B. KIT	W12-70-X
17	4	G0004DW0001	RUBBER PAD	DW SERIES, ϕ16*3.5t

Product List

SM89516L25, 25 MHz 64KB internal memory MCU
SM89516C25, 25 MHz 64KB internal memory MCU

Description

The SM89516 series product is an 8 - bit single chip micro controller with 64KB flash & 1KB RAM embedded. It is a derivative of the 8052 micro controller family. With its hardware features and powerful instruction set, it's straight forward to make it a versatile and cost effective controller for those applications which demand up to 32 I/O pins for 'DIP' package or up to 36 I/O pins for PLCC/QFP package, or applications which need up to 64KB memory either for program or for data or mixed.
To program the on-chip flash memory, a commercial writer is available to do it in parallel programming method.

Ordering Information

yywwv
SM89516tttik

yy: year, ww month
v: version identifier {, A, B,...}
i: process identifier {L=3.0V ~ 3.6V, C=4.5V ~ 5.5V}
ttt: working clock in MHz {25}
k: package type postfix (as below table)

Postfix	Package	Pin/Pad Configuration	Dimension
P	40L PDIP	page 2	page 16
J	44L PLCC	page 2	page 17
Q	44L QFP	page 2	page 18

Features

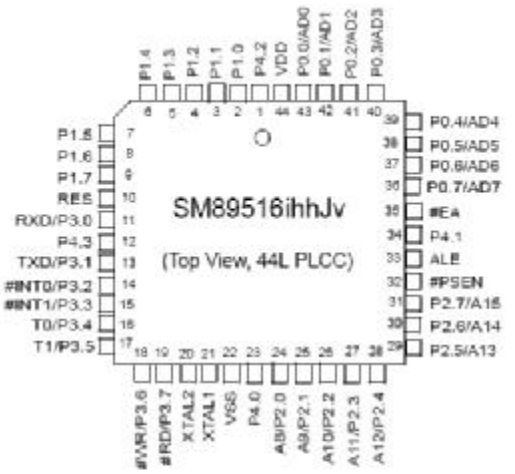
- Working voltage: 3.0V ~ 3.6V For L Version
  4.5V ~ 5.5V For C Version
- General 8052 family compatible
- 12 clocks per machine cycle
- 64 KB internal flash memory
- 1024 bytes data RAM
- Three 16 bit timers/counters
- Four 8-bit I/O ports for PDIP package
- Four 8-bit I/O ports + one 4-bit I/O ports for PLCC or QFP package
- Full duplex serial channel
- Bit operation instruction
- Page free jumps
- 8-bit unsigned division
- 8-bit unsigned multiply
- BCD arithmetic operations
- Direct addressing
- Indirect addressing
- Nested interrupts
- Two priority level interrupts
- A serial I/O port
- Power save modes:
  Idle mode and power down mode
- Code protection function
- One watch dog timer (WDT)
- Low EMI (inhibit ALE)

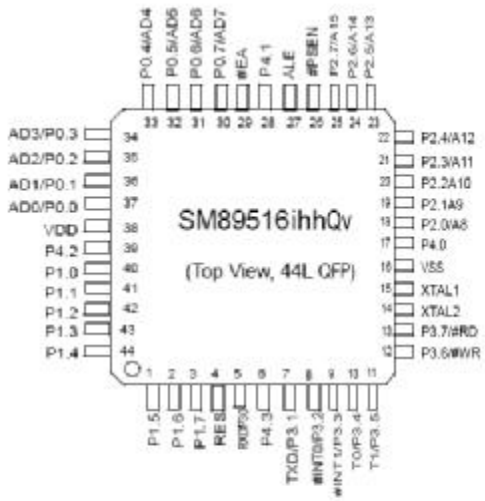
Taiwan
4F, No. 1 Creation Road 1,
Science-based Industrial Park,
Hsinchu, Taiwan 30077

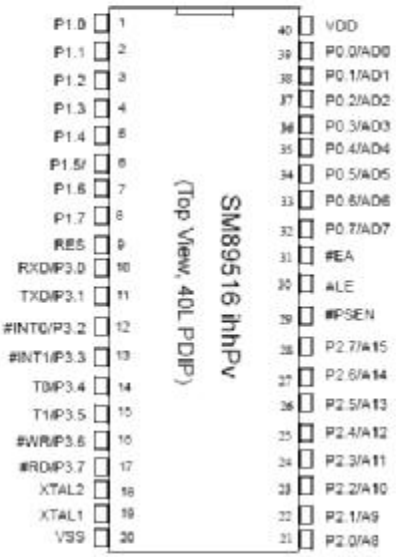
TEL: 886-3-578-3344 #2667
FAX: 886-3-579-2960
886-3-578-0403

Specifications subject to change without notice, contact your sales representatives for the most recent information.

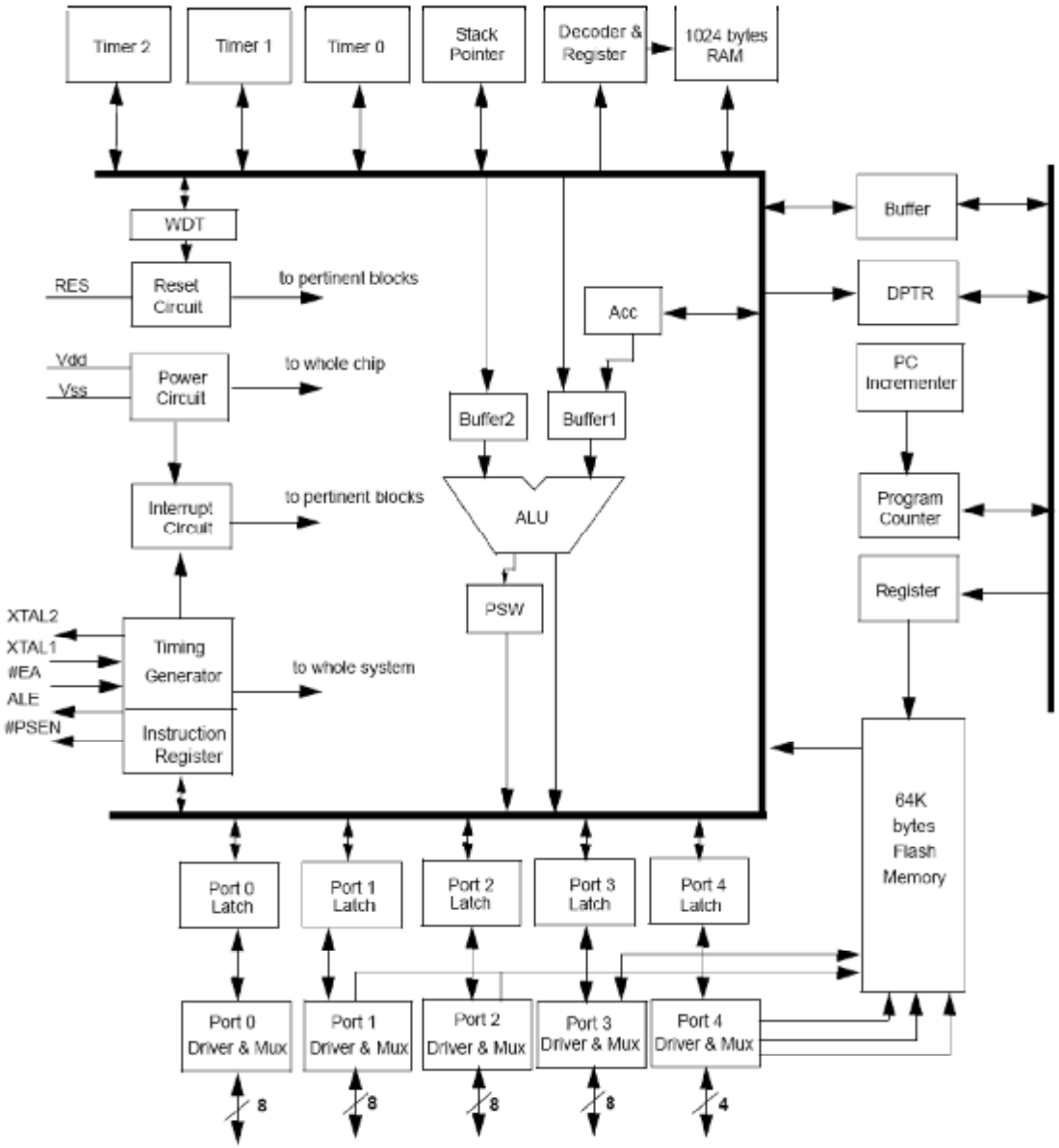
Pin Configurations







Block Diagram



Specifications subject to change without notice,contact your sales representatives for the most recent information.

Bridge Transducer ADC

AD7730/AD7730L

KEY FEATURES
Resolution of 230,000 Counts (Peak-to-Peak)
Offset Drift: 5 nV/°C
Gain Drift: 2 ppm/°C
Line Frequency Rejection: >150 dB
Buffered Differential Inputs
Programmable Filter Cutoffs
Specified for Drift Over Time
Operates with Reference Voltages of 1 V to 5 V

ADDITIONAL FEATURES
Two-Channel Programmable Gain Front End
On-Chip DAC for Offset/TARE Removal
***FASTStep*™ Mode**
AC or DC Excitation
Single Supply Operation

APPLICATIONS
Weigh Scales
Pressure Measurement

GENERAL DESCRIPTION

The AD7730 is a complete analog front end for weigh-scale and pressure measurement applications. The device accepts low level signals directly from a transducer and outputs a serial digital word. The input signal is applied to a proprietary programmable gain front end based around an analog modulator. The modulator output is processed by a low pass programmable digital filter, allowing adjustment of filter cutoff, output rate and settling time.

The part features two buffered differential programmable gain analog inputs as well as a differential reference input. The part operates from a single +5 V supply. It accepts four unipolar analog input ranges: 0 mV to +10 mV, 20 mV, +40 mV and 80 mV and four bipolar ranges: ±10 mV, ±20 mV, ±40 mV and ±80 mV. The peak-to-peak resolution achievable directly from the part is 1 in 230,000 counts. An on chip 6 bit DAC allows the removal of TARE voltages. Clock signals for synchronizing ac excitation of the bridge are also provided.

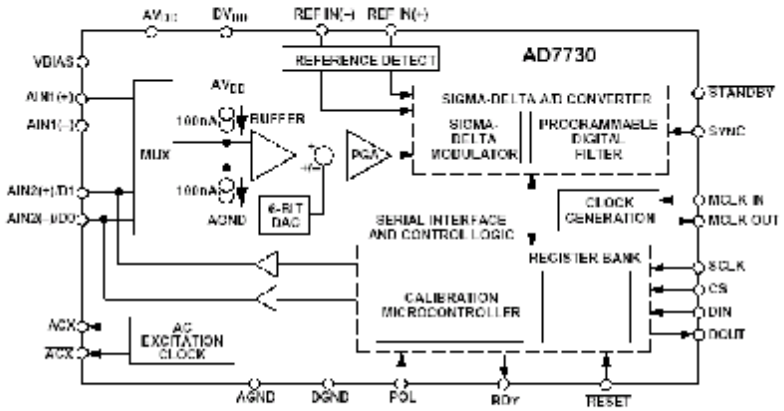
The serial interface on the part can be configured for three wire operation and is compatible with microcontrollers and digital signal processors. The AD7730 contains self calibration and system calibration options, and features an offset drift of less than 5 nV/°C and a gain drift of less than 2 ppm/°C.

The AD7730 is available in a 24-pin plastic DIP, a 24-lead SOIC and 24-lead TSSOP package. The AD7730L is available in a 24-lead SOIC and 24-lead TSSOP package.

NOTE

The description of the functions and operation given in this data sheet apply to both the AD7730 and AD7730L. Specifications and performance parameters differ for the parts. Specifications for the AD7730L are outlined in Appendix A.

FUNCTIONAL BLOCK DIAGRAM



FASTStep is a trademark of Analog Devices, Inc.

REV. A

Information furnished by Analog Devices is believed to be accurate and reliable. However, no responsibility is assumed by Analog Devices for its use, nor for any infringements of patents or other rights of third parties which may result from its use. No license is granted by implication or otherwise under any patent or patent rights of Analog Devices.

One Technology Way, P.O. Box 9106, Norwood, MA 02062-9106, U.S.A.
Tel: 781/329-4700 World Wide Web Site: http://www.analog.com
Fax: 781/326-8703
© Analog Devices, Inc., 1998

AD7730–SPECIFICATIONS (AV_{DD} = +5 V, DV_{DD} = +3 V or +5 V; REF IN(+) = AV_{DD}; REF IN(–) = AGND = DGND = 0 V; f_{CLKIN} = 4.9152 MHz. All specifications T_{MIN} to T_{MAX} unless otherwise noted.)

Parameter	B Version[1]	Units	Conditions/Comments
STATIC PERFORMANCE (CHP = 1)			
No Missing Codes[2]	24	Bits min	
Output Noise and Update Rates[2]	See Tables I & II		
Integral Nonlinearity	18	ppm of FSR max	
Offset Error[3]	See Note 3		Offset Error and Offset Drift Refer to Both Unipolar Offset and Bipolar Zero Errors
Offset Drift vs. Temperature[4]	5	nV/°C typ	
Offset Drift vs. Time[4]	20	nV/1000 Hours typ	
Positive Full-Scale Error[4, 5]	See Note 3		
Positive Full-Scale Drift vs. Temp[2, 6, 7]	2	ppm of FSR/°C max	
Positive Full Scale Drift vs Time[6]	10	ppm of FSR/1000 Hours typ	
Gain Error[2, 8]	See Note 3		
Gain Drift vs. Temperature[2, 7, 8]	2	ppm/°C max	
Gain Drift vs. Time[6]	10	ppm/1000 Hours typ	
Bipolar Negative Full-Scale Error[2]	See Note 3		
Negative Full-Scale Drift vs. Temp[2, 7]	2	ppm of FSR/°C max	
Power Supply Rejection	120	dB typ	Measured with Zero Differential Voltage
Common Mode Rejection (CMR)	120	dB min	At DC. Measured with Zero Differential Voltage
Analog Input DC Bias Current[2]	50	nA max	
Analog Input DC Bias Current Drift[7]	100	pA/°C typ	
Analog Input DC Offset Current[2]	10	nA max	
Analog Input DC Offset Current Drift[7]	50	pA/°C typ	
STATIC PERFORMANCE (CHP = 0)[2]			
No Missing Codes	24	Bits min	SKIP = 0[9]
Output Noise and Update Rates	See Tables III & IV		
Integral Nonlinearity	18	ppm of FSR max	
Offset Error	See Note 3		Offset Error and Offset Drift Refer to Both Unipolar Offset and Bipolar Zero Errors
Offset Drift vs. Temperature[4]	0.5	µV/°C typ	
Offset Drift vs. Time[4]	2.5	µV/1000 Hours typ	
Positive Full Scale Error[5]	See Note 3		
Positive Full-Scale Drift vs. Temp[6, 7]	0.6	µV/°C typ	
Positive Full Scale Drift vs. Time[6]	3	µV/1000 Hours typ	
Gain Error[8]	See Note 3		
Gain Drift vs. Temperature[3, 7]	2	ppm/°C typ	
Gain Drift vs. Time[6]	10	ppm/1000 Hours typ	
Bipolar Negative Full Scale Error	See Note 3		
Negative Full-Scale Drift vs. Temp	0.6	µV/°C typ	
Power Supply Rejection	90	dB typ	Measured with Zero Differential Voltage
Common Mode Rejection (CMR) on AIN	100	dB typ	At DC. Measured with Zero Differential Voltage
CMR on REF IN	120	dB typ	At DC. Measured with Zero Differential Voltage
Analog Input DC Bias Current	60	nA max	
Analog Input DC Bias Current Drift	150	pA/°C typ	
Analog Input DC Offset Current	30	nA max	
Analog Input DC Offset Current Drift	100	pA/°C typ	
ANALOG INPUTS/REFERENCE INPUTS			
Normal-Mode 50 Hz Rejection[2]	88	dB min	From 49 Hz to 51 Hz
Normal Mode 60 Hz Rejection[2]	88	dB min	From 59 Hz to 61 Hz
Common-Mode 50 Hz Rejection[2]	120	dB min	From 49 Hz to 51 Hz
Common Mode 60 Hz Rejection[2]	120	dB min	From 59 Hz to 61 Hz
Analog Inputs			
Differential Input Voltage Ranges[11]			Assuming 2.5 V or 5 V Reference with HIREF Bit Set Appropriately
	0 to +10 or −10	mV nom	Gain = 250
	0 to +20 or −20	mV nom	Gain = 125
	0 to +40 or −40	mV nom	Gain = 62.5
	0 to +80 or −80	mV nom	Gain = 31.25
Absolute/Common Mode Voltage[12]	AGND − 1.2 V	V min	
	AV_{DD} − 0.95 V	V max	
Reference Input			
REF IN(+) − REF IN(−) Voltage	+2.5	V nom	HIREF Bit of Mode Register = 0
REF IN(+) − REF IN(−) Voltage	+5	V nom	HIREF Bit of Mode Register = 1
Absolute/Common-Mode Voltage[13]	AGND − 30 mV	V min	
	AV_{DD} + 30 mV	V max	
NO REF Trigger Voltage	0.3	V min	NO REF Bit Active if V_{REF} Below This Voltage
	0.65	V max	NO REF Bit Inactive if V_{REF} Above This Voltage

Parameter	B Version[1]	Units	Conditions/Comments
LOGIC INPUTS			
Input Current	+10	μA max	
All Inputs Except SCLK and MCLK IN			
V_{INL}, Input Low Voltage	0.8	V max	DV_{DD} = +5 V
V_{INL}, Input Low Voltage	0.4	V max	DV_{DD} = +3 V
V_{INH}, Input High Voltage	2.0	V min	
SCLK Only (Schmitt-Triggered Input)			
V_{T+}	1.4/3	V min to V max	DV_{DD} = +5 V
V_{T+}	1.0/2.5	V min to V max	DV_{DD} = +3 V
V_{T-}	0.8/1.4	V min to V max	DV_{DD} = +5 V
V_{T-}	0.4/1.1	V min to V max	DV_{DD} = +3 V
$V_{T+} - V_{T-}$	0.4/1.8	V min to V max	DV_{DD} = +5 V
$V_{T+} - V_{T-}$	0.4/1.8	V min to V max	DV_{DD} = +3 V
MCLK IN Only			
V_{INL}, Input Low Voltage	0.8	V max	DV_{DD} = +5 V
V_{INL}, Input Low Voltage	0.4	V max	DV_{DD} = +3 V
V_{INH}, Input High Voltage	3.5	V min	DV_{DD} = +5 V
V_{INH}, Input High Voltage	2.5	V min	DV_{DD} = +3 V
LOGIC OUTPUTS (Including MCLK OUT)			
V_{OL}, Output Low Voltage	0.4	V max	I_{SINK} = 800 μA Except for MCLK OUT[14]; V_{DD}[15] = +5 V
V_{OL}, Output Low Voltage	0.4	V max	I_{SINK} = 100 μA Except for MCLK OUT[14]; V_{DD}[15] = +3 V
V_{OH}, Output High Voltage	4.0	V min	I_{SOURCE} = 200 μA Except for MCLK OUT[14]; V_{DD}[15] = +5 V
V_{OH}, Output High Voltage	V_{DD} – 0.5 V	V min	I_{SOURCE} = 100 μA Except for MCLK OUT[14]; V_{DD}[15] = +3 V
Floating State Leakage Current	±10	μA max	
Floating State Output Capacitance[2]	9	pF typ	
TRANSDUCER BURNOUT			
AIN(+) Current	100	nA nom	
AIN(–) Current	100	nA nom	
Initial Tolerance @ 25°C	±10	% typ	
Drift[2]	0.1	%/°C typ	
OFFSET (ZERO) DAC			
Resolution	8	Bits	
LSB Size	2.3/2.6	mV min/mV max	2.5 mV Nominal with 5 V Reference (REF IN/2000)
DAC Drift[16]	2.5	ppm/°C max	
DAC Drift vs. Time[2, 16]	25	ppm/1000 Hours typ	
Differential Linearity	±0.25/–0.25	LSB max	Guaranteed Monotonic
SYSTEM CALIBRATION			
Positive Full-Scale Calibration Limit[17]	1.05 × FS	V max	FS Is the Nominal Full-Scale Voltage (10 mV, 20 mV, 40 mV or 80 mV)
Negative Full-Scale Calibration Limit[17]	–1.05 × FS	V max	
Offset Calibration Limit[18]	–1.05 × FS	V max	
Input Span[17]	0.8 × FS	V min	
	2.1 × FS	V max	
POWER REQUIREMENTS			
Power Supply Voltages			
AV_{DD} – AGND Voltage	–4.75 to –5.25	V min to V max	
DV_{DD} Voltage	+2.7 to +5.25	V min to V max	With AGND = 0 V
Power Supply Currents			External MCLK, Digital I/Ps = 0 V or DV_{DD}
AV_{DD} Current (Normal Mode)	10.5	mA max	All Input Ranges Except 0 mV to +10 mV and –10 mV
AV_{DD} Current (Normal Mode)	22.5	mA max	Input Ranges of 0 mV to +10 mV and –10 mV Only
DV_{DD} Current (Normal Mode)	1.3	mA max	DV_{DD} of 2.7 V to 3.3 V
DV_{DD} Current (Normal Mode)	2.7	mA max	DV_{DD} of 4.75 V to 5.25 V
AV_{DD} + DV_{DD} Current (Standby Mode)	25	μA max	Typically 10 μA, External MCLK IN = 0 V or DV_{DD}
Power Dissipation			AV_{DD} = DV_{DD} = +3 V, Digital I/Ps = 0 V or DV_{DD}
Normal Mode	85	mW max	All Input Ranges Except 0 mV to +10 mV and –10 mV
	125	mW max	Input Ranges of 0 mV to +10 mV and –10 mV Only
Standby Mode	125	μW max	Typically 50 μW, External MCLK IN = 0 V or DV_{DD}

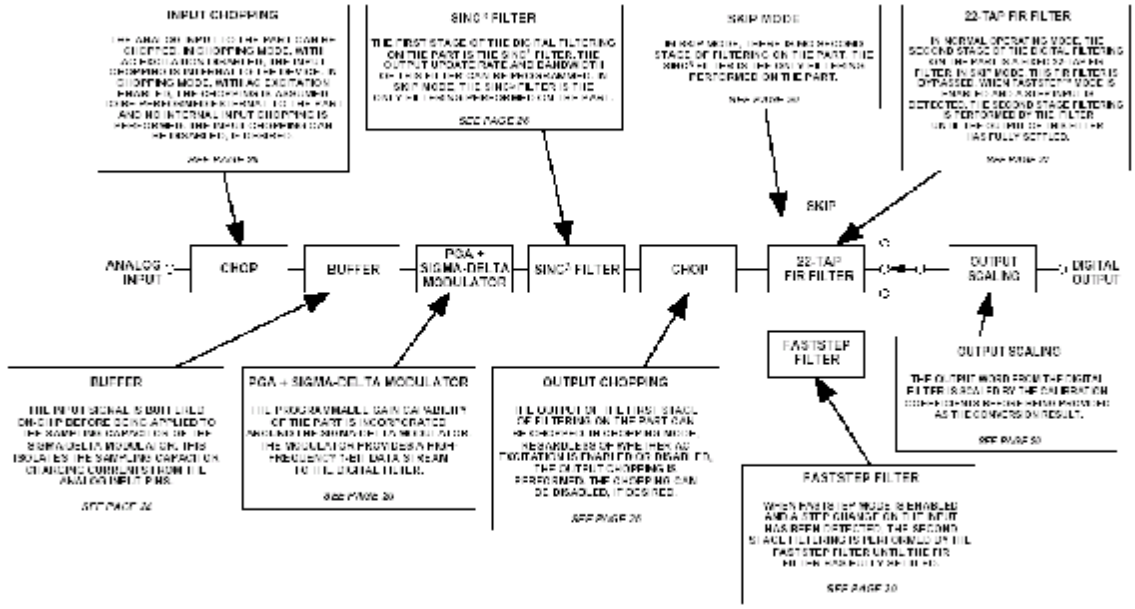
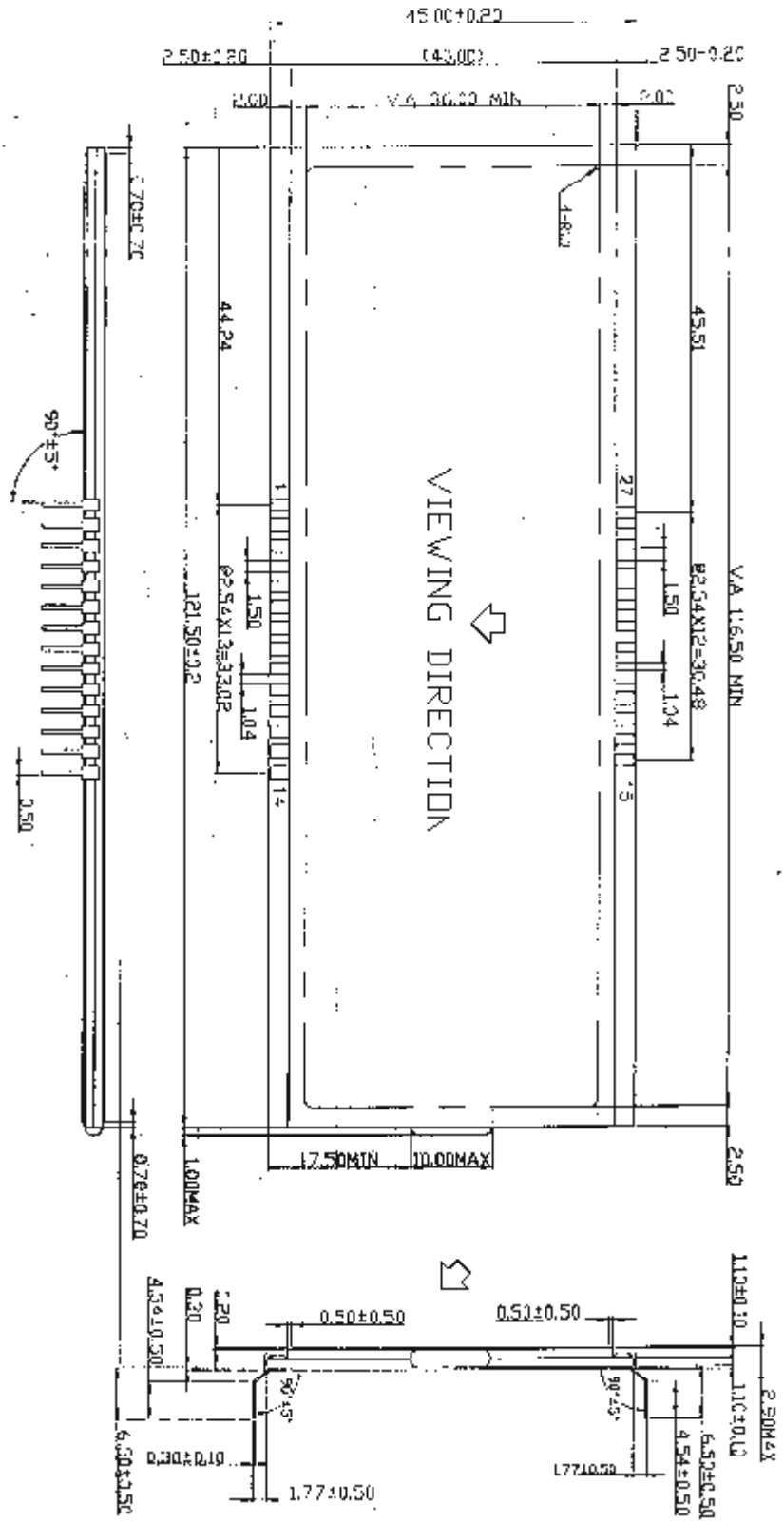


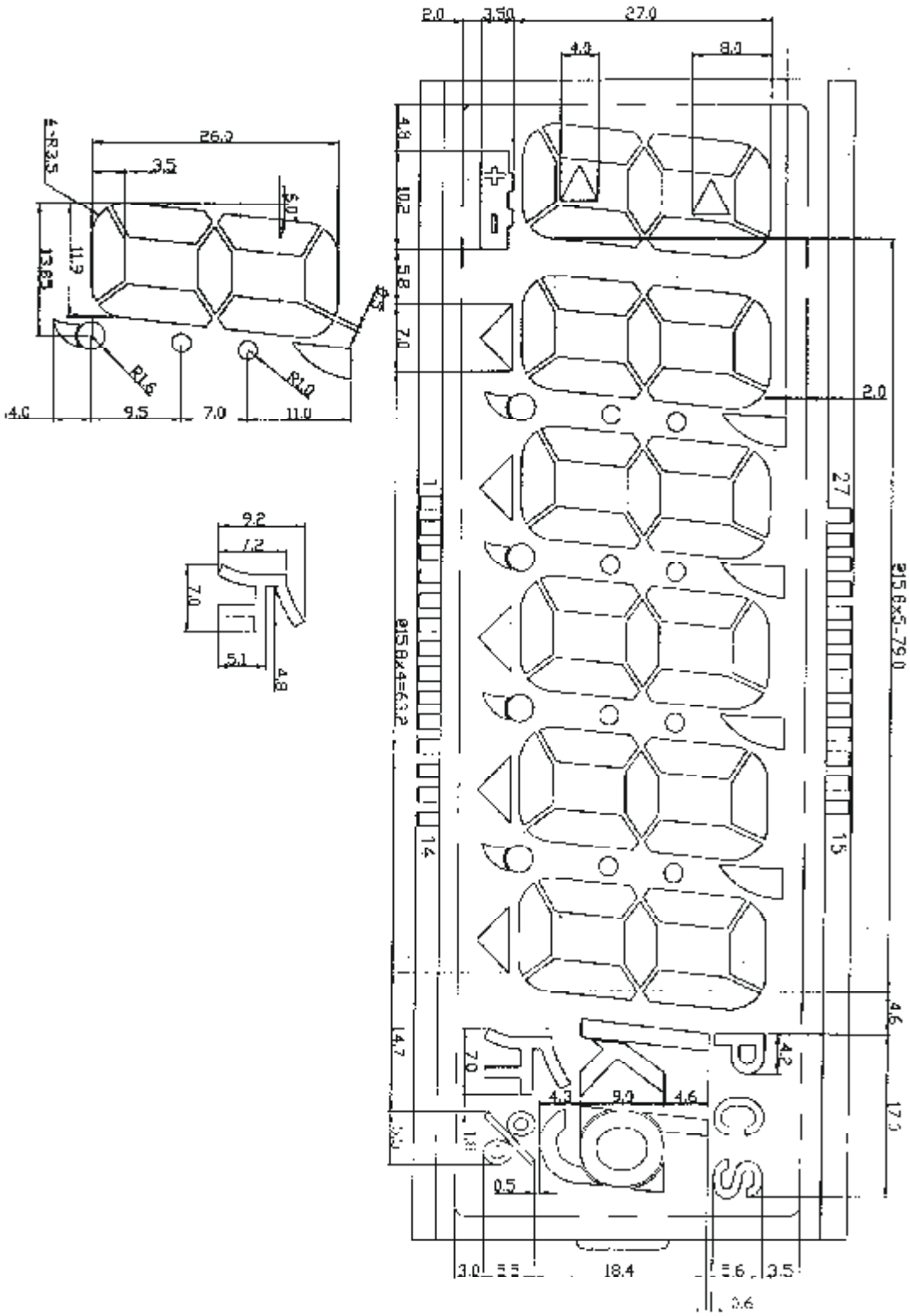
Figure 3. Signal Processing Chain

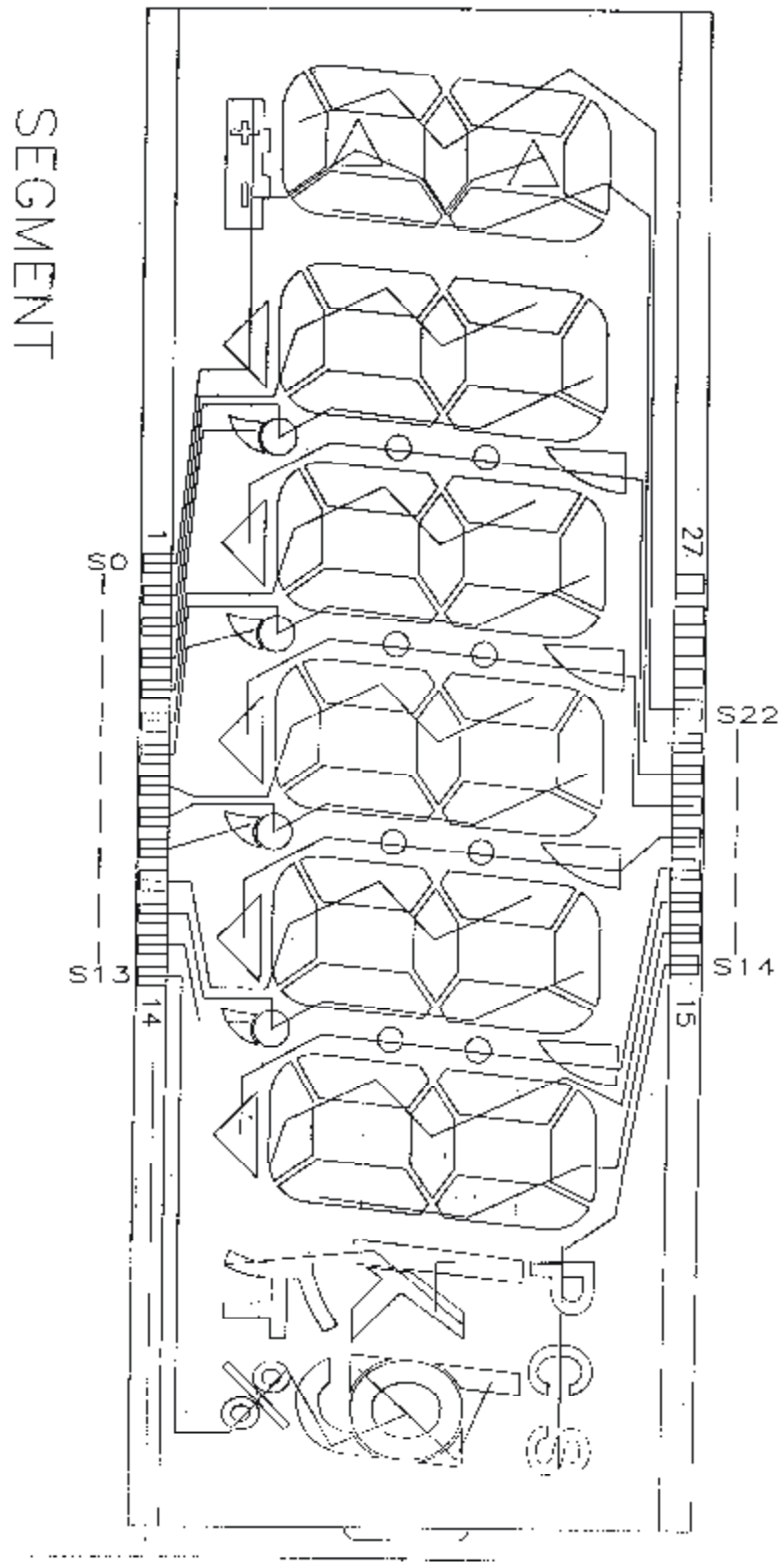
PIN CONFIGURATION

PIN FUNCTION DESCRIPTIONS

Pin No.	Mnemonic	Function
1	SCLK	Serial Clock. Schmitt-Triggered Logic Input. An external serial clock is applied to this input to transfer serial data to or from the AD7730. This serial clock can be a continuous clock with all data transmitted in a continuous train of pulses. Alternatively, it can be a noncontinuous clock with the information being transmitted to or from the AD7730 in smaller batches of data.
2	MCLK IN	Master Clock signal for the device. This can be provided in the form of a crystal/resonator or external clock. A crystal/resonator can be tied across the MCLK IN and MCLK OUT pins. Alternatively, the MCLK IN pin can be driven with a CMOS-compatible clock and MCLK OUT left unconnected. The AD7730 is specified with a clock input frequency of 4.9152 MHz while the AD7730L is specified with a clock input frequency of 2.4576 MHz.


VIEWING DIRECTION
V.A. 36.32 MIN
V.A. 1:6.50 MIN
44.24
45.51
121.50±0.2
17.50MIN
10.00MAX
1.00MAX
0.50±0.50
0.51±0.50
1.77±0.50
90°±5°


2.0
3.50
27.0
4.0
8.0
4-R3.5
26.2
3.5
6.0
11.2
13.65
R1.6
R1.0
4.6
9.5
7.0
11.0
9.2
7.2
7.0
5.1
4.8
10.2
5.8
7.0
2.0
27
15.6×5=79.0
15.8×4=63.2
14
15
14.7
7.0
4.2
4.3
9.0
4.6
17.3
0.5
3.0
5.5
18.4
5.6
3.5
3.6


SEGMENT
S0
S13
S22
S14
1
14
27
15

COMMON
1
14
15
27
COM0
COM1
COM2
COM3